United States Department of Agriculture

Cibola National Forest Draft Land Management Plan

Draft Environmental Impact Statement

DEIS Volume 1, Chapters 1, 2, 3, and 4

Bernalillo, Catron, Cibola, Lincoln, McKinley, Sandoval, Sierra, Socorro, Torrance, and Valencia Counties, New Mexico



Forest Service Cibola National Forest MB-R3-03-29 August 2019

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Cover photo: Western front range of the Sandia Mountains within the Sandia Ranger District. The Sandia Ranger District is located in central New Mexico, adjacent and east of the middle Rio Grande Valley (William Stone Photography).

Draft Environmental Impact Statement for the Cibola National Forest Draft Land Management Plan

McKinley, Cibola, Sandoval, Bernalillo, Torrance, Valencia, Lincoln, Socorro, Catron, and Sierra Counties, New Mexico

Lead Agency: USDA Forest Service

Cooperating Agencies: Acoma Pueblo, Bernalillo County, Bureau of Land Management, Canon de Carnuel, Catron County, Chilili Land Grant, Cibola County, City of Albuquerque, City of Gallup, City of Grants, Ciudad Soil and Water Conservation District, Claunch-Pinto Soil and Water Conservation District, Coronado Soil and Water Conservation District, East Torrance Soil and Water Conservation District, Edgewood Soil and Water Conservation District, Kirtland Air Force Base, Lava Soil and Water Conservation District, Lincoln County, Manzano Land Grant, McKinley County, McKinley Soil and Water Conservation District, Merced del Pueblo de Torreon, National Park Service, New Mexico Department of Agriculture, New Mexico Department of Cultural Affairs-Historic Properties Division, New Mexico Department of Game and Fish, New Mexico Environment Department, New Mexico Land Grant Council, Pueblo de Cochiti, Pueblo of Isleta, Pueblo of San Felipe, Pueblo of Santa Ana, Salado Soil and Water Conservation District, San Antonio de Las Huertas Land Grant, Sandoval County Fire Department, Sierra County, Sierra Soil and Water Conservation District, Socorro County, Tajique Land Grant, Torrance County, Valencia Soil and Water Conservation District, Village of Magdalena

Responsible Official: Steven Hattenbach, Forest Supervisor
Cibola National Forest and National Grasslands
2113 Osuna Rd NE
Albuquerque, NM 87113

For Information Contact: Sarah Browne, Forest Planner
Cibola National Forest and National Grasslands
2113 Osuna Rd NE
Albuquerque, NM 87113
(505) 346-3900

Abstract: This is the draft environmental impact statement that contains the analysis of four alternatives developed for programmatic management of the Cibola National Forest, composed of the Mount Taylor, Magdalena, Mountainair, and Sandia Ranger Districts, consisting of 1.6 million acres. The proposed alternatives consist of the no-action alternative which is the existing 1985 Land and Resource Management Plan (1985 plan), alternative B which is the place-based management areas alternative, alternative C which has an accelerated restoration emphasis and is the proposed action and revised draft plan, and alternative D which has a backcountry emphasis.

Summary

This draft environmental impact statement documents the analysis of alternatives developed for the programmatic management of approximately 1.6 million acres of the Cibola National Forest. The proposed action will replace the 1985 Cibola National Forest Land and Resource Management Plan, as amended (1985 plan), which guides all natural resource management activities on the Cibola. The revised draft land management plan (draft land management plan) is intended to address new information and concerns raised since the 1985 plan was published; meet the objectives of federal laws, regulations, and policies; address the changes in management anticipated to be needed over the next 15 years identified in the analysis of the management situation; provide for clear direction in the form of desired conditions, objectives, standards, guidelines, suitability, management areas, and monitoring; incorporate the best available science; and provide a framework for adaptive management.

Four alternatives for revising the 1985 plan are described, compared, and analyzed in detail in this draft environmental impact statement. The analysis displays the anticipated progress toward the desired conditions as well as the potential environmental and social consequences of implementing each alternative. Alternative A is the no-action alternative; it represents the 1985 plan and is referred to as the 1985 plan, current management, or no-action alternative. Alternative C is the revised draft plan and proposed action. The proposed action includes a reorganization and restructure of the land management plan; more sustainable, ecologically based and descriptive desired conditions; updated objectives; changes to standards and guidelines; new management areas including focused restoration management area (318,148 acres) and backcountry recreation conservation management area (36,547 acres); recommendations for designating 24,265 acres of additional wilderness areas; and a recalculation of the projected timber sale quantity and projected wood sale quantity of timber resources. The proposed action focuses on the needs for change to (1) minimize risks to ecological integrity by supporting resiliency of forested ecosystems toward reference conditions and restoring historic fire regimes; (2) protect and restore water resources and watersheds; (3) address management area configuration compatible with resource direction on a landscape basis and (4) address management of historic and contemporary cultural uses by tribes and traditional communities. In addition to the needs for change, the proposed plan provides direction for uses and ecosystem services including sustainable recreation opportunities, traditional uses, livestock grazing, primitive and backcountry uses, and species persistence.

Alternative B is similar to the proposed action, but includes place-based management areas to provide plan direction that is unique from forest wide direction for watersheds, cultural resources, recreation, and vegetation resources, and recommends additional wilderness areas for a total of 55,779 acres. Alternative D is similar to alternative B and C, except that no lands would be managed for place-based management areas, restoration management areas, or conservation management areas. Alternative D differs from the other alternatives as it recommends the most acreage of recommended wilderness areas with 203,117 acres. Overall, the analysis performed for this draft environmental impact statement indicates that the proposed action (alternative C) would be most effective at meeting management needs and achieving desired conditions.

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Chapter 1. Purpose of and Need for Action

Document Structure

The Forest Service has prepared this draft environmental impact statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This draft environmental impact statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized as follows:

- **Chapter 1. Purpose of and Need for Action:** Includes information on the needs for change (purpose of and need for the project) and the Agency's proposal (draft land management plan) for achieving that purpose and need. This section also details how the Forest Service involved the public in the development of the draft land management plan and how the public responded.
- **Chapter 2. Alternatives, Including the Proposed Action:** Provides a more detailed description of the draft land management plan (proposed action) as well as alternative methods for addressing needs for change. These alternatives were developed based on significant issues raised by the public and other agencies. This section also provides a summary table of the environmental consequences associated with each alternative.
- **Chapter 3. Affected Environment and Environmental Consequences:** Describes the physical, biological, social, and economic environments affected by the draft land management plan and the environmental consequences of implementing the draft plan and other alternatives. This analysis is organized by resource area. This chapter also includes other required disclosures including short-term uses and long-term productivity, irreversible and irretrievable commitments of resources.
- **Chapter 4. Preparers, Consultation, and Coordination:** A brief identification of the individuals involved, their qualifications, and the specific portion of the draft environmental impact statement they contributed to. List of agencies, groups, organizations, or individuals with whom the Cibola has consulted and coordinated with during the development of the draft land management plan and draft environmental impact statement.
- **Distribution of the Environmental Impact Statement:** Any group, organization, agency, or individual that received a copy of the draft environmental impact statement is identified in this section.
- **References:** All literature cited in the body of the draft environmental impact statement is identified in full detail here.
- **Glossary:** List of terms and definitions or explanations that are used throughout the document.
- **Index:** An alphabetized list of subjects discussed in the draft environmental impact statement, giving the page or pages on which each item is mentioned.
- **Appendices:** Appendices A through F provide more detailed information to support the analysis presented in the environmental impact statement.
    - **Appendix A**. Public Engagement and Coordination with Other Planning Efforts
    - **Appendix B.** Description of the Analysis Process
    - **Appendix C.** Wilderness Recommendation Process

- **Appendix D.** Documentation of the Wild and Scenic Rivers Eligibility Process
- **Appendix E.** Crosswalk for At-Risk Wildlife Species
- **Appendix F.** Crosswalk for At-Risk Fish and Plants Species

Additional documentation, including more detailed analyses of project area resources, may be found in the project planning record located at the Cibola National Forest Supervisor's Office. Key analysis documents can be found on the Cibola plan revision website at http://www.fs.usda.gov/goto/cibola/plan.

Location

The Cibola National Forest is one of five national forests in New Mexico. It is comprised of four mountain districts and manages the Kiowa, Rita Blanca, McClellan Creek, and Black Kettle National Grasslands. This draft environmental impact statement addresses the National Forest System lands within the Cibola National Forest which are located within McKinley, Cibola, Sandoval, Bernalillo, Torrance, Valencia, Lincoln, Socorro, Catron, and Sierra Counties. The Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands are addressed separately in the Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands Land and Resource Management Plan, which was completed in 2012 (USDA Forest Service 2012a).

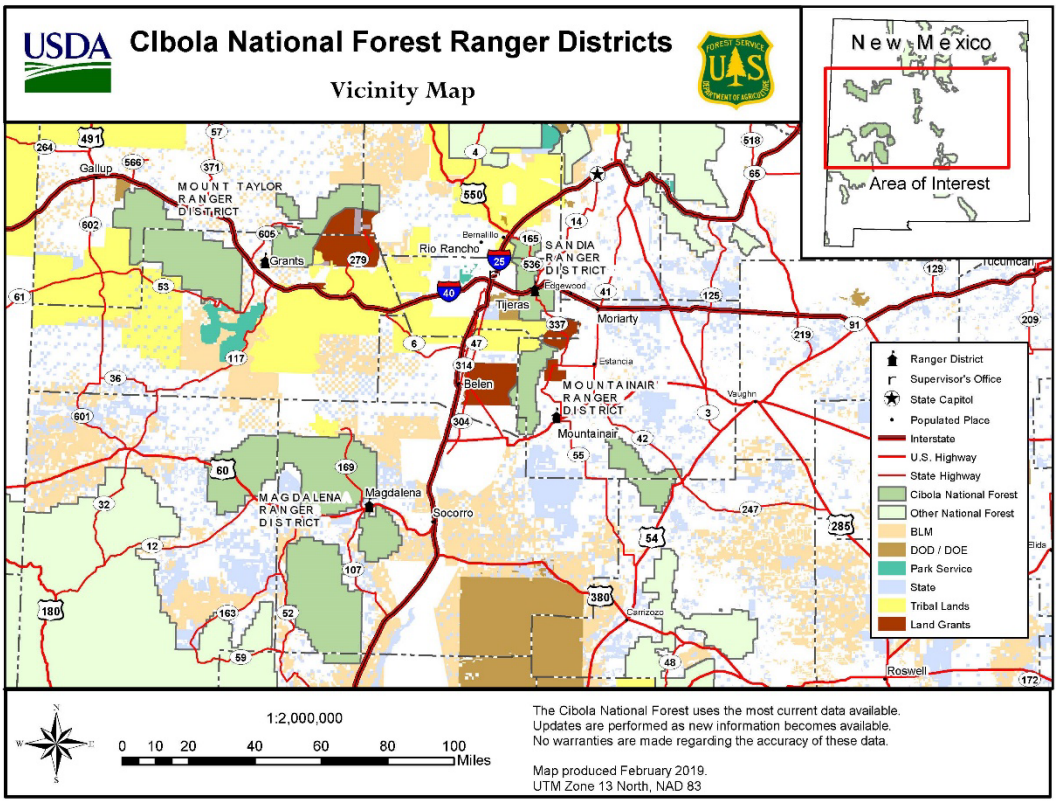


Figure 1. Vicinity of the Cibola National Forest showing county boundaries, major highways, and other State, Federal, Tribal, and land grant jurisdictions. The inset shows the location of the Cibola within New Mexico.

The plan area of the Cibola covers more than 1.6 million acres, with elevations ranging from 5,300 feet to over 11,300 feet. The four ranger districts addressed in the draft environmental impact statement are Mount Taylor, Magdalena, Mountainair, and Sandia. Within these four districts are ten separate mountain ranges ("sky islands") scattered throughout central New Mexico: Zuni, Mount Taylor, Magdalena, Bear, Datil, San Mateo, Manzano, Gallinas, Manzanita, and Sandia Mountains.

Purpose and Needs for Change

The 1985 Land and Resource Management Plan for the Cibola National Forest (1985 plan), including 16 amendments, is the primary document currently guiding Cibola's forest management. The National Forest Management Act (NFMA) of 1976 directs every national forest to revise its land management plan on a 10- to 15-year cycle; when conditions or demands in the area covered by the land management plan have changed significantly; when changes in agency policies, goals, or objectives would have a significant effect on forest-level programs; and when monitoring and evaluation indicate a revision is necessary.

Over 30 years have passed since the regional forester approved the Cibola's 1985 plan. The last 34 years have provided new scientific information and understanding, along with changes in socioeconomic and ecological conditions, resulting in a shift in management emphasis from outputs to outcomes. The revised plan is designed to meet the legal requirements of the National Forest Management Act and to incorporate new scientific, traditional, and cultural knowledge into forest management. A complete revision of the 1985 plan is needed to (1) meet the legal requirements of the National Forest Management Act and the provisions of the 2012 Planning Rule, (2) guide natural resource management activities on the Cibola for the next 10 to 15 years, and (3) address the needs for change in management direction.

Cibola National Forest personnel conducted an evaluation of how current management under the 1985 plan was affecting ecological and socioeconomic conditions and trends taking place on the national forest and associated "needs for change" to be addressed in the draft land management plan. This analysis is documented in two volumes completed in February 2015: the "Assessment Report of Ecological/Social/Economic Conditions, Trends, and Risks to Sustainability" (USDA Forest Service 2015a, 2015b) and needs for change statements for 15 focused resource areas in the "Executive Summary of Key Findings" (https://origin-fs.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3857287.pdf). Supporting analysis can be found within the Assessment Report volumes I and II, the needs for change document, and the notice of intent at the following link on the Cibola plan revision website at http://www.fs.usda.gov/goto/cibola/plan.

The priority needs for change have been grouped here into four main themes that focus the scope of this plan revision.

Respect Cultural and Traditional Landscapes and Uses

There is a need for plan direction that recognizes the Cibola's role in contributing to traditional and cultural forest uses and local economies.

The Cibola contains distinctive landscapes, cultural histories, and socioeconomic characteristics that contribute to the surrounding communities. The Cibola contributes resources and uses, which are important to federally recognized tribes and pueblos, land grant communities, acequia associations, and other communities that pre-date the establishment of the national forests, all with historic, cultural, and social connections to the Cibola.

There is a need for plan direction to inventory, stabilize, preserve, interpret, and protect historic and sensitive properties, (for example, archaeological sites, historic structures, and traditional cultural properties). There is also a need for plan direction that addresses management of historic and contemporary cultural uses by federally recognized Indian Tribes and traditional communities not considered under tribal relations.

There is a need for alignment of management of historic properties and landscapes, sacred sites, contemporary uses, and tribal needs with other resource management objectives. This need to integrate forest management (such as ecosystem restoration) with tribal needs utilizes an "all lands" approach to resources management. Updated plan direction needs to address consistency of activities with legally mandated trust responsibilities to tribes.

The 1985 plan does not recognize livestock grazing and fuelwood gathering as important uses to be continued on the Cibola, and it does not contain direction for a sustainable recreation program able to adapt to changes in demand, available resources, and opportunities. Most wood products from the Cibola are in the form of fuelwood and small-diameter forest products that are significant for traditional and cultural uses and economic contributions. Mechanized harvesting of forest products is also an important component to maintaining appropriate vegetation characteristics. There is a need for plan direction that provides for the use of a variety of forest products by commercial, noncommercial, tribal, land grant, and other rural traditional communities.

Manage Holistically for Watershed and Ecosystem Health

Ecological conditions of the Cibola have changed since the 1985 plan, including the recognition that vegetation conditions (structure, composition, and function) are divergent from reference conditions; forest conditions indicate a substantial departure from the natural fire regime; and plant and animal species need further consideration in the planning process. Across most of the Cibola, plant community structure and fire regime bear little resemblance to pre-European conditions. Historical timber harvest, livestock grazing (removal of fine fuels), and fire suppression are largely responsible for decreased fire frequency, increased fire severity, larger patch size, and the resulting overall decrease in large trees and increases in early seral (grass/forb/shrub, seedling/sapling) stands and closed canopies in forests and woodlands. In shrublands and grasslands, decreased fire frequency has facilitated tree encroachment and the corresponding decrease in patch size. There is a need for plan direction that recognizes the interdependence of resources and provides for all-inclusive (holistic) and adaptive management to better respond to changing environmental conditions. The ecological and socioeconomic benefits of restoring historic stand structure and reduction of the risk for uncharacteristic fires are primary areas of focus in this plan revision.

There is a need to provide plan direction to move the condition of highly departed vegetation types toward desired conditions to support resiliency of the vegetation community composition and structure and minimize risks to ecosystem integrity. Desired conditions, objectives, standards, and guidelines are necessary to promote restoration of natural disturbance cycles where appropriate. Updated plan direction is needed to promote the maintenance and restoration of soil condition and function (soil hydrology, soil stability, nutrient cycling). This need for updated plan direction supports an all-lands approach of working with neighboring land managers where natural systems span multiple administrative boundaries.

There is a need for plan direction that recognizes the natural processes of fire and its use as a management tool for vegetation types on the Cibola that supports integrated resource objectives. This integrated resource approach includes the use of planned fire and addresses fuel accumulations in the wildland-urban interface.

Water resources are limited across the Cibola, and water is a previous resource for wildlife, livestock, ecosystem and watershed health, and communities. There is a need to provide updated plan direction for the protection, maintenance, and restoration of riparian vegetation and channel morphology in the plan area and for restoration of priority watersheds. There is a need for standards and guidelines that minimize the ecological impacts of multiple uses in riparian areas, and a recognition of their reliance on upland ecological health.

There is a need for plan direction that supports the maintenance of ecological conditions that contribute to the recovery and conservation of federally recognized species, maintaining viable populations of species of conservation concern, and common and abundant species within the plan area. Plan direction is also needed to address terrestrial, riparian, and aquatic habitat connectivity for species movement across the landscape.

Manage for Sustainable Recreation and Multiple Uses

There is a need for plan direction that recognizes the Cibola's role in contributing to service-based sectors, such as recreation and tourism, timber, range, and other multiple-use-related activities and products.

The ability of the Cibola to provide a sustainable recreation program is at risk, reflecting increasing and changing demands from the public with limited internal capacity and resource degradation due to high visitation. There is a need to add plan guidance for managing recreation activities that occur in areas sensitive to resource degradation and at risk due to high visitation while addressing user conflicts. As well, there is a need for plan direction on sustainable recreation management to provide high-quality recreational experiences that are consistent and integrated with other forest resources. Other updated plan direction needed is on the Continental Divide National Scenic Trail and for managing recreational aviation activities, caves, and recreational activities associated with wildlife, fish, and cultural or historic sites. The integration of the recreation opportunity spectrum and the Scenery Management System into all resource management decisions is necessary.

There is a need for plan direction to identify and evaluate potential additions to the National Wilderness Preservation System and evaluate river corridor eligibility for inclusion in the National Wild and Scenic Rivers System. In addition, plan direction for designated and recommended wilderness areas is needed to protect and enhance wilderness values and characteristics.

There is a need for plan direction on the management of infrastructure and for road maintenance in watersheds identified as being impaired or at risk. The restoration of these impaired watersheds needs to also incorporate adaptive management plan direction toward ecosystem-based desired conditions for the livestock grazing program.

In terms of restoration treatments, there is a need to identify those geographic areas and vegetation types that are most outside of the natural range of variation. These treatments need to consider the capability of local infrastructure, contractors, and timber markets including for commercial use, noncommercial use, tribal use, land grant use, or a combination of these uses.

The Cibola's land program is in need of updated plan direction to obtain legal access that addresses public, private landowner, tribal, land grant, and management needs. As well, updated desired conditions are needed for progress toward a contiguity of the land base and a reduction of small unmanageable tracts.

Support for all Resources

Overall, there are multiple needs to address either by plan direction or other plan content throughout the plan and integrated across multiple resource areas. Plan direction needs to identify desired conditions with objectives for how resources should be managed, eliminate redundancies with existing laws, regulations and policy, and incorporates the best available scientific information into all plan components. There is also a need to reconfigure the management area configuration used in the 1985 plan to better address geographic management emphases or compatible resource direction on a landscape basis.

There is a need for updated plan direction that addresses potential climate change effects on the Cibola, as well as a plan monitoring program that includes adaptive management. Monitoring at appropriate scales is needed with the inclusion of areas adjacent to the Cibola in terms of broad-scale monitoring on a larger scale.

Across all resource management the Cibola has to better recognize the role of the national forest in supporting local economies through both commodity production and services such as recreation and tourism. This key focus on partnerships is needed in the updated plan direction to implement the proposed management through an all-lands approach with multiple partners such as, but not limited to, State and Federal agencies, cities and counties, tribal governments, nongovernmental organizations, land grant communities, and other traditional communities, local communities, and youth.

Decision Framework

The forest supervisor of the Cibola is the responsible official for this project and will make the final decision on the selected alternative for the draft land management plan. The forest supervisor will review the proposed action (draft land management plan), the other alternatives, and their environmental consequences and decide which plan alternative best meets the desired conditions, the identified needs for change and issues raised during the scoping process, diverse needs of the people, and sustainable management of the Cibola, as well as the requirements of the National Forest Management Act of 1976 and the Multiple-Use Sustained-Yield Act of 1960.

Based on the analysis in this draft environmental impact statement and subsequent public comments, the responsible official will prepare a final environmental impact statement and identify a selected alternative in a draft record of decision that will be subject to an objection process guided by direction in 36 CFR subpart B (219.50 to 219.62). A final record of decision and accompanying land management plan will set a course of action for managing the Cibola for the next 10 to 15 years. The plan is strategic in nature and does not specifically authorize any projects or activities. Site-specific decisions are made following project-level proposals and environmental analysis, with additional opportunities for public involvement.

Proposed Action

The Cibola proposes to revise its 1985 plan to provide strategic, program-level guidance for management of the Cibola's resources and uses over the next 10 to 15 years. Proposed changes to the 1985 plan include incorporating resource desired conditions and new management areas, updated objectives, changes to standards and guidelines, recalculation of timber suitability, monitoring requirements, and recommendations for potential wilderness areas. The draft land management plan reorganizes and restructures the 1985 plan management areas to move the majority of the land toward forestwide desired conditions and adds broad purpose-based management areas that emphasize restoration and conservation management differences across the Cibola. The proposed action (draft land management plan) focuses on the needs for change identified in the assessment and incorporates significant issues raised during the scoping process.

The land management plan is comprised of plan components that guide future project activity and decision making that include the following:

- Desired conditions describe the specific social, economic, or ecological characteristics for each resource, designated area, and management area toward which future management of the land and resources should be directed and form the basis for the types of projects, activities, and uses that occur under the land management plan.
- Objectives focus on feasible targets for making progress toward attaining desired conditions in some of the highest priority areas that had the biggest need for change; for example, fire and fuels, vegetation, and watersheds,.
- Standards provide required design criteria to focus and constrain management actions to move resources toward or keep resources in desired conditions throughout the draft land management plan, especially in areas with the biggest need for change such as vegetation, fire and fuels, rangelands, cultural and historic resources, dispersed recreation, recommended and designated wilderness areas.
- Guidelines provide design or operational constraints on projects and activities to help achieve or maintain desired conditions, to avoid undesirable effects, or to meet applicable legal requirements. Guidelines serve the same purpose as standards but they differ from standards in that they provide flexibility in defining compliance, while standards are absolute constraints.
- Suitability determinations from the recalculation of the planned timber sale quantity and sustained yield of the Cibola direct which areas within the national forest are suitable for specific activities based on applicable desired conditions.
- Designated areas and management areas, such as recommended management areas, restoration management areas, and conservation management areas, identify parts of the Cibola that need unique management direction than what is provided for forestwide resources.

Specific details about the proposed action are provided in chapter 2.

Public Involvement and Collaborative Planning

Per the 2012 Planning Rule, Cibola personnel have engaged the public frequently and innovatively throughout the planning process. This effort has included conventional public meetings, collaborative work sessions, information sharing via social media, and the development of self-convening groups organized around each of the four mountain ranger districts.

Members of the public have submitted comments at each major milestone in plan revision to date including the assessment, the notice of intent and the needs for change, and the preliminary draft plan (posted on the Cibola plan revision website at http://www.fs.usda.gov/goto/cibola/plan).

During November 2012, Cibola staff held a total of six public meetings to announce the kickoff of land management plan revision activities and to seek comment and input on the assessment report. During May 2014, seven public meetings, two tribal meetings, and one technical meeting were held around the Cibola. At this time, key findings from the draft assessment report were presented and comments were requested. In February 2015, the needs-for-change statements were released and a notice of intent to prepare an environmental impact statement was published in the Federal Register.

The wilderness inventory process was initiated in September 2014 with a draft inventory map of lands that may be suitable for inclusion in the National Wilderness Preservation System along with public meetings and an informal comment period. Because of the high level of interest in this process, Cibola personnel incorporated public comments received and released a set of phase 2 inventory maps and other plan materials in July 2015. There also was an informal comment period and public meetings held in conjunction with these releases.

In addition to the phase 2 wilderness inventory products that were released in July 2015, draft forestwide desired conditions and draft vision statements for each of the four districts were also released in conjunction with public meetings and a comment review period. Comments received were used to revise these materials, and a preliminary draft plan was released to the public in July 2016. Public meetings and an informal comment period were held in conjunction with the release of these draft materials. Alternative B reflects the site-specific place-based managements areas presented within the preliminary draft plan. The public input collected from the preliminary draft plan helped Cibola personnel further refine the draft land management plan into the proposed action—alternative C.

Since the spring of 2015, Cibola staff have collaborated with other units of government as cooperating agencies. The National Environmental Policy Act allows a lead Federal agency, such as the Cibola National Forest, to invite other units of government to participate in the National Environmental Policy Act process (40 CFR section 1501.6; 1508.5). This formal relationship allows Cibola staff to request the participation of each agency early in the process and to use the environmental analyses and proposals of cooperating agencies to the extent possible. Forty-three cooperating agencies have signed a memorandum of understanding as units of government representing diverse interests and communities such as soil and water conservation districts, city and County governments, six of the 17 tribes with whom Cibola personnel formally consult on this plan revision effort, land grants, and State and Federal agencies.

In 2016, the Cibola personnel and cooperating agencies participated in the formation of a collaborative for each of the four mountain districts and a forestwide collaborative—the Cibola Shared Stewardship Collaborative. Cibola personnel joined with partners to kick off these formal collaboration teams consisting of members of the public and nonprofit and government entities. The purpose of the Cibola Shared Stewardship Collaborative is to provide input to the Cibola leadership team on the use and management of the Cibola's multiple resources.

In the fall of 2018, Cibola personnel released an updated version of the draft land management plan along with a previous version of this draft environmental impact statement on its website. Public open houses were held to collect input from the district collaboratives, the general public, and the cooperating agencies. Comments received from the cooperating agencies on the draft land management plan and the draft environmental impact statement were addressed and incorporated into this version of the draft environmental impact statement where feasible.

Issues that Served as the Basis for Alternative Development

The public, other agencies, and tribes submitted 47 comments in response to the notice of intent and needs for change, published in the Federal Register in February 2015. Since that time, over 2,500 additional comments have been received on the draft land management plan and draft environmental impact statement; comments were from the public, cooperating agencies, nongovernmental organizations, land grants, and tribes.

Scoping comments were analyzed to identify issues and frame their associated cause and effect relationships that may occur from the proposed action or alternatives. The issues were then grouped into the following five categories presented here. Alternatives were developed around those issues that involved unresolved conflicts during the iterative development of the proposed plan (see chapter 2 for more information on alternative development).

Issue A: Support Cultural and Traditional Landscapes and Uses

The lands within the Cibola have a long history of human use dating back to time immemorial. Cultural and traditional communities around the Cibola rely on the National Forest System lands for physical and cultural subsistence (for example, grazing, firewood collection, traditional herb gathering), their traditional way of life, and rural prosperity. The traditional production-based economy of National Forest System lands that drove the 1985 plan is not as feasible in central New Mexico due to changing ecosystems and economies. These issues were raised in comments from scoping and incorporated into the draft land management plan.

The draft land management plan recognizes the importance of access and conservation of culturally significant traditional gathering areas for forest products on the Cibola, enhanced protection of cultural sacred sites, maintenance of acequias, and other traditional uses. Some comments expressed the importance of motorized access to these areas, while others appreciated nonmotorized access due to providing more privacy.

Comments were received about balancing culturally based traditional uses with increasing demands for nontraditional uses. User conflicts exist. Traditional and cultural uses are not compatible with some recreational uses, such as mountain biking, motorized uses, rock climbing, and backpacking. Protection of the Cibola's natural, cultural, and historic landscapes and the values associated with these unique places and features need to be balanced with the public's ability to access and enjoy them.

Livestock grazing is one specific traditional use that had differing public comments. Some commented on its importance for maintenance of their culture, traditions, and livelihood as well as providing rural prosperity. The draft land management plan desired conditions include provisions for resilient ecosystems that continue to supply forage for both livestock and wildlife. Other members of the public commented that livestock grazing can have adverse consequences on watersheds and want to see it reduced. Watershed plan direction in the draft land management plan aim to address watershed restoration, connectivity, and health.

Issue B: Restore Resilient Ecosystems

Overall, during scoping, public comments supported the need to move the forest toward desired conditions that are more resilient to anticipated future changes. Comments received wanted to restore vegetation composition and structure so that it returns to historic conditions and has a reduced risk of uncharacteristic wildfires. The draft land management plan focuses on restoring the most departed frequent fire systems, Ponderosa Pine and Mixed Conifer-Frequent Fire vegetation types, which are the Cibola's majority forest types. Scoping comments were in agreement about the need to restore the Cibola's terrestrial and aquatic ecosystems; however, there are diverging comments about where and how these efforts should occur. Some comments received were from members of the public who are opposed to mechanical treatments and prefer more prescribed fire on the land and others who prefer the benefits of mechanical treatments in terms of contributions to the local small-scale diameter timber industry. This unresolved conflict with the method of restoration drives some of the differences among the proposed alternatives.

As well, much public concern exists that the Cibola isn't doing enough restoration projects and that ecological resilience may not actually be accomplished with implementation of the proposed action.

Many public commenters expressed a desire for the Cibola to provide high-quality habitat for wildlife species, such as mammals, game species, birds, native fish, and native plants. However, opinions differ in which species are most important and in need of management. Other comments stressed the need for the plan to account for wildlife connectivity. The draft land management plan seeks to provide guidance that allows for the continued persistence of all native species on the Cibola and provide for wildlife connectivity.

Issue C: Provide for Watershed Health

Degradation of the Cibola's water sources can occur from various sources and causes, such as misuse and climate change. Because of this degradation, there were many public comments received about the type and location of water resource improvement projects we are conducting on the Cibola. Comments were in agreement that healthy, proper functioning conditions of watersheds are instrumental to the health, resiliency, and future of all communities.

Healthy riparian areas and the water found in them were also identified by the public as important and in need of restoration. Diverging comments include those in support of protection for riparian areas and other comments in support for the use of the Cibola's water for activities such as recreation and livestock grazing.

It is recognized in scoping received to date that healthy riparian areas provide wildlife habitat for many plant and animal species. Native species play an essential role in the continued ecological function of the land and provide key socioeconomic and subsistence opportunities to the Cibola's diverse user groups.

Issue D: Address Conflicts between Recreation and Multiple Uses

The Cibola has a responsibility to provide resilient and relevant recreational opportunities representing a spectrum of recreation opportunities for current and future generations. Recreation users of the Cibola are diverse, and public comments received showed a multitude of perspectives on the best management to provide sustainable recreation opportunities. Additionally, public comment was received about the backlog of recreation deferred maintenance on the Cibola. Many areas on the Cibola have experienced an increased concentration of recreation use over the life of the 1985 plan, especially locations adjacent to high population areas. Commenters have expressed desires for a variety of recreation opportunities as well as better maintained and new recreation trails.

There are varying concerns about the way Cibola staff can provide a sustainable recreation program, including interest in maintaining and enhancing current recreational opportunities, requests for new opportunities, and reducing conflict among current and future recreation uses.

Public opinions are divided on the appropriate mix of different types of recreation settings and opportunities that should be provided. The draft land management plan has been developed to try and provide a balance of recreation opportunities. Some commenters wanted additional developed recreation facilities and advocated for more motorized recreation, while others supported more dispersed and nonmotorized recreation or primitive recreation opportunities. There are also conflicts over the amount of land that should be managed for motorized versus nonmotorized activities. This unresolved conflict concerning the type of recreational opportunities to provide under the draft land management plan differentiated the alternatives.

Issue E: Consider New Wilderness and Management Areas

The 2012 Planning Rule requires the forest to evaluate areas for recommended wilderness and public comments were divided on the desire to see these areas in the draft land management plan. There was a wide variety of opinions of whether the Cibola should recommended more wilderness areas. The draft land management plan recommends seven new additions that are contiguous to existing wilderness areas. Many comments received from scoping to date are from individuals and groups who have identified areas as recommended wilderness areas. Commenters stressed the significance of the ecological, geological, scientific, educational, scenic, spiritual, and historical values and features of these recommended wilderness areas. Many of these commenters desired an experience of solitude in a remote and primitive location that would be protected from further development.

Other comments received have requested no additional areas be recommended as wilderness because of the concern their current uses of these areas may then be restricted. The public commented about potential impacts to current uses in recommended wilderness areas, expressed concern that motorized and mechanized uses would no longer be allowed to continue, and noted this would have socioeconomic impacts on these current uses. Plan direction for recommended wilderness areas prohibits mechanized and motorized uses which then causes some unresolved conflicts with those existing uses. Many commenters also felt the amount of designated wilderness on the Cibola is adequate.

Many public comments identified certain areas with unique features or uses throughout the Cibola, and commenters wanted these areas to have unique management from the forestwide direction. Some included protection of ecological resources such as watersheds, unique botanical communities and natural features, cultural resources, and managing for specific recreational uses. Updated forestwide plan direction for resource protections and the range of management areas within the proposed alternatives respond to these comments.

Chapter 2. Alternatives, Including the Proposed Action

This chapter describes each alternative considered for the revision of the 1985 plan. It also presents the alternatives in comparative form, describing the differences between each and providing a basis for choice among options for the responsible official. Some of the information used to compare alternatives is based on the land management plan decisions (for example, objectives, special management areas) and some of the information is based on expected outcomes of implementing each alternative (for example, amount of forest products available). Summary tables compare potential future activities by alternative.

Alternative Development Process

The range of alternatives were developed to encompass the diverse possibilities for management of the Cibola and unresolved issues. The proposed draft land management plan (alternative C) was developed iteratively in a collaborative manner to address the needs for change. In August 2015, Cibola personnel released an initial set of draft desired conditions for public and cooperating agency review and input. After incorporating comments and refining the desired conditions, the forests released a preliminary draft land management plan for review and comment in June 2016. These collaborative efforts between the Cibola personnel and external groups and individuals led to development of the proposed draft land management plan (alternative C, proposed action). Two additional alternatives (alternatives B and D) were generated based on unresolved issues not addressed by the proposed draft land management plan. Alternative C represents an improvement on, and evolution from, alternative B which contains management areas that were represented in the preliminary draft plan shared with the Cibola's public in 2016. These unresolved issues are listed in chapter 1 under the section "Issues that Served as the Basis for Alternative Development."

Alternative C was developed to respond to issues raised about ecosystem resiliency by placing more emphasis on treating vegetation mechanically along with prescribed fire to contribute to the local and regional small-diameter sawtimber industry and maintain or move the Cibola toward desired conditions. This alternative places an emphasis on accelerated restoration focused in key restoration management areas (318,148 acres), and provides for enhanced primitive backcountry recreation opportunities in conservation management areas (36,547 acres) while still allowing for restoration activity, with 8 recommended wilderness additions (24,265 acres). This alternative recommends less acreage than alternatives B and D for wilderness designation. This alternative identifies more land suitable for timber production among the action alternatives and would offer more forest products and fuelwood.

Alternative B was developed in response to public and cooperating agency recommendations for management areas to provide plan direction that is unique from forestwide direction for watersheds, cultural resources, recreation, and vegetation resources. In particular, the Mount Taylor, Jumanos Pueblos, and Fort Wingate Management Areas respond to tribal and agency interest for preservation of traditional cultural properties, historic buildings and sites, and cultural landscapes. Las Huertas Management Area and Fourth of July Canyon Management Area emphasize watershed health and unique botanical and natural features, as well as access to sacred sites, traditional cultural properties, and culturally significant plants. Alternative B contains most of the same management direction as alternative C. It also responds to the issues raised for more primitive recreation opportunities by recommending more acreage for wilderness designation at 55,779 acres than alternative C but less than alternative D.

Alternative D was developed to respond to issues raised for more solitude, remoteness, and primitive recreation in addition to the desire for restoration to rely on prescribed and natural fire with minimal mechanical thinning. It contains the most acreage of recommended wilderness among the action alternatives at 203,117 acres, including many areas the public and wilderness advocates identified for consideration. These areas emphasize backcountry recreation and decrease the intensity of restoration treatments with more emphasis on dispersed and nonmotorized recreation than managed recreation.

The draft land management plan and proposed alternatives were shared with the public and cooperating agencies during fall 2018. Four public meetings and meetings with the Cibola's district collaboratives were held to gather feedback as to whether these proposed alternatives addressed concerns and whether the range of alternatives was adequate.

The interdisciplinary team considered this feedback and comments received from the cooperating agencies during the fall of 2018, and the team refined the initial draft alternatives released in 2018. This is reflected in the action alternatives (alternatives B, C, and D) below.

Alternatives Considered in Detail

The interdisciplinary team developed four alternatives: alternative A (1985 plan); alternative C, proposed action (draft land management plan); alternative B, where multiple site-specific special management areas would be emphasized; and alternative D, where natural processes and primitive backcountry uses would be emphasized. These alternatives were developed in response to issues described in chapter 1.

Elements Common to Alternatives

All four alternatives share a number of features. In particular, they all:

- comply with applicable laws, regulations, and policies (see appendix D of the draft land management plan for a list of the most prevalent);
- contain plan decisions including desired conditions, objectives, standards, guidelines, timber suitability, and monitoring;
- include mechanical treatments including thinning, while offering opportunities for fuelwood collection when projects allow;
- conserve soil and water resources and do not allow significant or permanent impairment of the productivity of the land;
- provide protection for riparian areas;
- maintain air quality that meets or exceed applicable Federal, State, and local standards and regulations;
- provide appropriate habitat to support species' viability and critical habitat for threatened and endangered species across the planning area;
- use a common list of species of conservation concern; the species of conservation concern were selected based on regional guidance and recommendations from Forest, and State agency specialists;
- protect cultural resources;
- provide sustained multiple uses, products, and services in an environmentally acceptable manner (including timber, livestock forage, recreation opportunities, and leasable and locatable minerals);

- incorporate amendments with plan direction;
- manage for special qualities of existing designated areas (wilderness; inventoried roadless areas; research natural areas; wild and scenic rivers; and scenic byways);
- include 7 eligible wild and scenic rivers (displayed in the map packet) with plan components developed to maintain their outstandingly remarkable values; and
- provide direction for existing designated areas including designated wilderness areas, inventoried roadless areas, scenic byways, the Continental Divide National Scenic Trail, Bernalillo Watershed Research Natural Area, Sandia Cave National Historic Landmark and other significant caves, and congressionally designated areas such as T'uf Shur Bien Preservation Trust Area, Military Withdrawal Area, and the Langmuir Research Site and Magdalena Ridge Observatory.

In addition, progress toward meeting desired conditions and objectives, and the effectiveness of standards and guidelines are evaluated by a monitoring plan that provides continual feedback and evaluation.

Elements Common to Action Alternatives B, C, and D

Alternatives B, C, and D also share a number of features. In particular, they all:

- emphasize vegetation treatments (mechanical, prescribed or managed wildfires) in frequent-fire forested systems (ponderosa pine and mixed conifer-frequent fire) that are highly departed from the vegetative desired conditions and historic fire regimes;
- include restoration treatments in riparian areas, including treatments such as stream channel and habitat restoration, watershed restoration, and invasive species removal;
- provide direction on invasive species management in multiple vegetation types and for the benefit of native and at-risk species;
- include opportunities to leverage partnerships and collaboration;
- recognize and support cultural and traditional landscapes and uses of federally recognized tribes, lands grants, and rural historic communities;
- emphasize sustainable recreation and integration with other resource management;
- use the scenic integrity objective system to manage for varying levels of scenery across the Cibola; and
- provide management direction for recommended wilderness management areas.

Alternative A – No Action and 1985 plan

Under the no-action alternative; the 1985 plan, as amended, would continue to guide management of the Cibola. Alternative A emphasizes timber management over restoration and emphasizes suppression across the landscape. Protection for riparian areas is emphasized. Plan direction does not address managing for traditional communities and uses, ecosystem and watershed restoration, and sustainable recreation. The Cibola would also remain divided into the current 18 management areas that cover the entire national forest.

Issue A: Support Cultural and Traditional Landscapes and Uses

Alternative A does not include any standards or guidelines that address cultural and traditional uses of the Cibola and how to support these uses. The only direction emphasizes protection of archaeological sites; however, without articulated desired conditions, standards, and guidelines of how to achieve this protection. The 1985 plan is silent on land grants, rural historic communities, and their traditional uses of the Cibola.

The 1985 plan aims to reduce the level of livestock grazing, while intensifying management including new fencelines, pipelines, and watering sources. Overstory modification and brush control activities are also mentioned to improve range conditions. However, with the absence of specific objectives and guidelines for improving vegetation, including forage, this can be difficult. Also, the absence of objectives for range infrastructure maintenance and improvements can impact grazing numbers and ecological health.

The proposed amount of fuelwood under alternative A through the issuance of fuelwood permits would be the least amongst all alternatives at 9,000 to 12,000 cords annually. Rural historic communities utilize fuelwood for economic purposes along with heating their homes across the Cibola.

Issue B: Restore Resilient Ecosystems

Alternative A has no objectives for treating vegetation. The 1985 plan emphasizes standard vegetation management practices for certain composition, structure, and function attributes to be applied at the site and stand level. Current management uses mechanical treatments and wildfire (prescribed and managed) to restore forest health, reduce the risk of fire to communities, encourage small diameter sawtimber industries, and support local communities' forest product gathering for economic and traditional uses.

In regard to wildfire, the 1985 plan has suppression objectives and maximum acre limits for high- and low-intensity fires but is silent on maximum flame lengths. It outlines suppression strategies to follow manual and supplement direction that will be selected and implemented on all fires occurring on the Cibola. There is direction to develop fire management plans so unplanned ignitions may be classified as prescribed fires when meeting prescribed burning prescriptions to meet predetermined resource objectives.

A standard promotes naturally ignited wildfires but only in designated wilderness to allow wildfire to play a natural role.

There are no specific objectives for terrestrial wildlife habitat improvement other than direction to develop structural and nonstructural improvements for habitat enhancement including springs, trick tanks, food plots, overflows at windmills, impoundments, raptor, and song bird structures.

Objectives are on an annual basis for mechanical thinning, prescribed burns, and managed wildfire:

- mechanically treat 2,000 to 5,000 acres of highly departed areas (ponderosa pine and dry mixed conifer frequent fire types)
- prescribe burn 3,500 to 10,000 acres to reduce wildfire risk and restore conditions
- manage 2,000 to 5,000 acres of naturally ignited wildfires

Issue C: Provide for Watershed Health

The 1985 plan includes direction to improve watershed health. Most of this direction focuses on the road system as roads can have substantial impacts to watershed health. Plan direction includes direction to obliterate poorly located or constructed roadways to improve watershed condition and reduce soil loss at a specific rate.

This alternative does not include any objectives for riparian restoration but does include in-depth guidelines that describe how riparian areas should be managed for ground cover, shade, bank cover, streambed sedimentation, plant composition, plant structure, and crown cover.

There is an objective to annually improve water resource features by implementing at least 0 to 1 projects with this emphasis. Under infrastructure improvements, 1 mile of system roads or unauthorized routes would be relocated or improved annually to protect ecosystems and watersheds.

Issue D: Address Conflicts between Recreation and Multiple Uses

The 1985 plan allows for flexible levels of recreation site maintenance with the recreation opportunity spectrum. Certain developed recreation sites are specified to be managed for standard service level while others are identified to be managed at a less than standard level. There is an emphasis on maintained trails and expanding the trail system at specific locations and sites per year. The concept of sustainable recreation is not specifically mentioned nor are there specific objectives that would help achieve it. There are no articulated plan components to address user conflicts between recreation use and other multiple uses.

Objectives for dispersed recreation include evaluating and addressing up to 7 percent of forestwide trail system mileage for need, condition, use, relevance, and sustainability during the life of the plan. This is the least amount of system mileage proposed for evaluation amongst all alternatives.

Issue E: Consider New Wilderness and Management Areas

The 1985 plan does not include any recommended wilderness areas. Aside from the forestwide direction, the entire national forest is also divided into 18 management areas (see map packet), each with their own set of plan components based on their emphasis. Most management areas have multiple emphases, which can result in no specific emphasis occurring in those areas. The 18 management areas in the 1985 plan are defined as follows:

Management Area 1 - The management area is composed of the 37,232-acre Sandia Mountain Wilderness. The area is adjacent to the Albuquerque metropolitan area. Management emphasis: provide quality wilderness experience opportunities, dispersed recreation; wildlife diversity and ecosystem health maintained through prescribed natural fire management practices.

Management Area 2 - The 44,648-acre management area is the Sandia Ranger District excluding the Sandia Mountain Wilderness and the military withdrawals. Management emphasis is to provide opportunities for a variety of year-round recreational experiences, wildlife diversity and population viability maintained or improved through habitat management.

Management Area 3 -The 100,007-acre management area is composed of the Manzano Mountain Wilderness on the Mountainair Ranger District and the Apache Kid Wilderness and the Withington Wilderness on the Magdalena Ranger District. Management emphasis is to provide dispersed recreation opportunities compatible with maintaining wilderness values and protecting resources.

Management Area 4 -The 33,112-acre management area is administered by the Black Kettle Ranger District, which is not within the mountain districts analysis area.

Management Area 5 -The 230,842-acre management area is administered by the Kiowa and Rita Blanca Ranger Districts, which is not within the mountain districts analysis area.

Management Area 6 – Reserved.

Management Area 7 - The 30,606-acre management area consists of the Langmuir research site on the Magdalena Ranger District. The area is legislatively designated for atmospheric and astronomical research. Management emphasis is to preserve conditions necessary to meet research needs of Langmuir Laboratory.

Management Area 8 - The 194,099-acre management area is located on the Mount Taylor Ranger District. The primary management emphasis is on regulated even-aged timber management.

Management Area 9 - This is a 4,377-acre management area located on the Mount Taylor Ranger District. Primary emphasis is on wildlife.

Management Area 10 - This 5,932-acre management area is located on the Mount Taylor Ranger District. The primary emphasis is on maximum commercial timber production through regulated timber management.

Management Area 11 - The 102,430-acre management area located on the Magdalena (67,539 acres) and Mountainair Ranger Districts (34,891). Emphasis is to maintain forest and watershed health, vigor, and productivity, as well as provide and maintain wildlife habitat diversity and old growth.

Management Area 12 -The 35,428-acre management area is located on the Mountainair (9,798 acres) and Magdalena (25,630) acres) Ranger Districts. Emphasis is to maintain forest and watershed health, vigor, and productivity, as well as provide and maintain wildlife habitat diversity and old growth.

Management Area 13 -The 215,552-acre management area occurs on the Mountainair (7,845 acres), Mount Taylor (60,465 acres), and Magdalena (147,242 acres) Ranger Districts. The primary emphasis in on wildlife management activities.

Management Area 14 - This 236,185-acre management area is located on the Mount Taylor Ranger District. Emphasis is to manage Pinyon-juniper for personal use and commercial firewood. References 28 acres of potential research natural area (Little Water Canyon).

Management Area 15 - This 118,723-acre management area is located on the Mountainair Ranger District. Emphasis is on range and wildfire management activities.

Management Area 16 - The 457,146 acre management area is located on the Magdalena Ranger District's four mountain ranges. The primary emphasis is on range and wildlife management activities.

Management Area 17 - The 20,486-acre management area adjacent to the Albuquerque metropolitan area in the Sandia District is closed to public entry for security and safety purposes and is managed by Kirtland Air Force Base (15,891 acres) and the Department of Energy (4,595 acres).

Management Area 18 – The 17,419-acre management area is located on the Mount Taylor District, predominately on the Zuni Mountains. Management emphasis is to plant and then maximize commercial timber production. References 100 acres of potential research natural area (Bluewater Creek).

Alternative B – Place-Based Management Areas

Alternative B responds to public comments that forest management should emphasize areas across the Cibola that need unique plan direction from forestwide direction for watersheds, cultural resources, recreation, and vegetation resources. The forestwide plan direction outside the ten proposed management areas is the same as the proposed action. The proposed place-based management areas include the following: Mount Taylor Management Area, Little Water Canyon Management Area, Fort Wingate Management Area, Silver Hill Dark Skies Management Area, Pueblo Migrations Management Area, Fourth of July Canyon Management Area, Jumanos Pueblos Management Area, Cement Springs Management Area, and Las Huertas Canyon Management Area. The interdisciplinary planning team developed draft plan direction for each of these management areas which is available upon request in the Cibola administrative record under the file name "Place-based Management Areas" and available on the Cibola plan revision website at the following link: http://www.fs.usda.gov/goto/CibolaForestPlanRevision.

Issue A: Support Cultural and Traditional Landscapes and Uses

Alternative B includes separate plan direction for the following management areas that support cultural and traditional landscapes and uses. Each proposed management area includes the purpose and desired conditions that are relative to cultural and traditional uses.

- Mt. Taylor Management Area: Cultural resources and traditional use areas important to tribes are unimpaired and are visited by tribes in an atmosphere of solitude and privacy. This is a unique place where Tribes continue to perform ceremonial activities in accordance with traditional practices.
- Fort Wingate Management Area: The historic facility and environmental conditions demonstrates the biological significance of unique genotypes of sheep (Navajo churro sheep) and the sustainability of the oldest, most continuous, cultural and agro-ecological practices of pastoral cultures in desert environments. The archaeological integrity of the buildings and the Sheep Lab environmental conditions represents a setting and character reflective of the cultural landscape.
- Pueblo Migrations Management Area: The area provides unique archeological resources that represent the migration and social history of Pueblo people prior to Europeans arrival in the Southwest and during the 12th to 15th centuries. The area's settlements and ceremonial sites provide opportunities for scientific study, public interpretation, and traditional use by descendent communities where consistent with other resource needs.
- Jumanos Pueblos Management Area: The area is valued for the preservation, interpretation, tribal uses, and scientific study of three important prehistoric pueblo villages (Pueblo Colorado, Pueblo de la Mesa, and Pueblo Blanco).
- Cement Springs Management Area: The historic and cultural value of the site, and the role it played as a crossroads of culture, commerce, and conflict throughout human history, is recognized and valued.
- Las Huertas Management Area: Access is available to sacred sites, the Las Huertas traditional cultural property, and other locations of traditional uses for individual and group ceremonies, activities, and collection of forest products where permitted.

In addition to special provisions for cultural and traditional protection in these management areas, there would be a slight increase of proposed grazing allotments of 2 percent under alternative B. This is due to the updated plan direction allowing for the opportunity to consider re-opening historically closed allotments specified as significant for traditional communal grazing uses during scoping.

The proposed amount of fuelwood under alternative B through the issuance of fuelwood permits would be similar to alternative A and D at 9,000 to 12,000 cords annually. Rural historic communities utilize fuelwood for economic purposes along with heating their homes across the Cibola. This would be less cords issued than under alternative C.

Issue B: Restore Resilient Ecosystems

Alternative B emphasizes utilization of forest products by using a balance of mechanical treatments with wildfire to move toward vegetative desired conditions. This addresses desires for increased outputs of forest products from the Cibola. More amounts of prescribed fire would be used than managed wildfire for resource benefits from natural ignitions.

Objectives are on an annual basis for mechanical thinning, prescribed burns, and managed wildfire:

- mechanically treat 2,000 to 5,000 acres of highly departed areas (ponderosa pine and dry mixed conifer frequent fire types)
- prescribe burn 4,200 to 12,000 acres to reduce wildfire risk and restore conditions
- manage 2,200 to 5,500 acres of naturally ignited wildfires

Issue C: Provide for Watershed Health

Alternative B includes separate plan direction for the following management areas that provide for watershed health. Each proposed management area includes the purpose and desired conditions that are relative to how to restore watersheds.

- Las Huertas Management Area: The Las Huertas watershed is restored with capacity to provide for multiple uses, clean drinking water, and adequate water delivery for downstream users as consistent with other resource constraints. The watershed is functioning properly to maintain traditional practices.
- Little Water Canyon Management Area: The spring and stream provide substantial flows that are rare in the Zuni Mountains. The spring, stream, and vegetation provide microhabitats that are extremely important to aquatic and wildlife habitat.

In addition to these management areas, there is an objective to annually improve water resource features by implementing at least 1 to 2 projects with this emphasis. Under infrastructure improvements, 1 to 3 miles of system roads or unauthorized routes would be relocated or improved annually to protect ecosystems and watersheds.

Issue D: Address Conflicts between Recreation and Multiple Uses

Alternative B increases maintenance of recreation infrastructure and offers the possibility of accommodating more use. Objectives for dispersed recreation include evaluating and addressing up to 10 percent of forestwide trail system mileage for need, condition, use, relevance, and sustainability during the life of the plan. This increased emphasis on the trail system should provide increased user satisfaction with the recreation opportunities focus on the user conflicts that exist across the Cibola by evaluating the use and relevance of the trail.

Issue E: Consider New Wilderness and Management Areas

Alternative B recommends 55,779 acres for wilderness designation. The additions are mostly concentrated in the Magdalena Ranger District, specifically around expanding the Apache Kid Wilderness. Additionally, this alternative proposes expanding the Manzano Wilderness by 2,544 acres (Manzano Wilderness expansion 1, 2, 3, 4, and 5) on the Mountainair Ranger District. These recommended wilderness management areas are stand-alone and contiguous to existing designated wilderness areas contain high wilderness characteristics (overall H and H+ evaluation finding) with no existing or future uses incompatible with managing for recommended wilderness. These are areas from the phase 3 wilderness inventory that have had boundary adjustments to focus on where high wilderness characteristics, such as apparent naturalness, primitive recreation, solitude, manageability, and unique features, are present. Existing and future incompatible uses for managing the area as recommended wilderness were considered during the wilderness analysis process; the recommended wilderness management areas proposed in alternative B and C do not contain incompatible uses (see appendix C for further explanation on analysis process).

Alternative C – Proposed Action and Accelerated Restoration

Alternative C is the proposed action outlined in the draft land management plan, which focuses on healthy ecological function that supports multiple uses through an accelerated restoration focus. The interdisciplinary team developed this alternative iteratively with the public to address the needs for change and issues identified in chapter 1. It is designed to address needs for restored forested and non-forested vegetation, incorporating natural wildfires, wildlife terrestrial and aquatic habitat, improved riparian management zones, watershed health, improved rangeland forage and infrastructure, sustainable recreation, and desires for recommended wilderness.

Issue A: Support Cultural and Traditional Landscapes and Uses

The majority of plan direction associated with this issue is common to alternatives B and D. However, there would be a slight increase of proposed grazing allotments of 2 percent under alternative C. This is due to the updated plan direction allowing for the opportunity to consider reopening historically closed allotments specified as significant for traditional communal grazing uses during scoping.

The proposed amount of fuelwood under alternative C through the issuance of fuelwood permits would be more than alternatives A and D at 12,000 to 15,000 cords annually, the most issued among the action alternatives. Rural historic communities utilize fuelwood for economic purposes along with heating their homes across the Cibola.

Issue B: Restore Resilient Ecosystems

Alternative C emphasizes accelerated restoration using mechanical treatments with wildfire to move toward vegetative desired conditions in addition to proposed restoration management areas where these treatment projects would be focused. This addresses desires for increased outputs of forest products from the Cibola. More amounts of prescribed fire would be used than managed wildfire for resource benefits from natural ignitions. Under alternative C, there would be the most amount of treatments (mechanical and wildfire) proposed amongst the action alternatives.

Objectives are on an annual basis for mechanical thinning, prescribed burns, and managed wildfire:

- mechanically treat 2,800 to 7,000 acres of highly departed areas (ponderosa pine and dry mixed conifer frequent fire types)
- prescribe burn 4,900 to 14,000 acres to reduce wildfire risk and restore conditions
- manage 2,400 to 6,000 acres of naturally ignited wildfires

Unique to alternative C are the proposed restoration and conservation management areas. The focus of the restoration management areas is on landscape-based restoration projects that are currently being implemented or are under analysis with pending decisions. Emphasis is on intensive management, specifically on mechanical thinning, to reduce fire hazard, protect infrastructure, and to provide fuelwood collection where appropriate and in balance with other resource needs. The focus and emphasis for conservation management areas is to protect and enhance values such as uninterrupted wildlife habitat, solitude, and scenic integrity while still allowing for restoration activity. Under the restoration management area plan direction, the following plan components emphasize the restoration of ecosystems:

- ecosystems are resilient to drought, insects, disease, and uncharacteristic wildfires
- the composition, density, structure, and mosaic of vegetative conditions reduce uncharacteristic wildfire hazard to local communities
- fuelwood is readily available to communities and partners in balance with other resource constraints
- forest management should result in wildfires that are low- to mixed-severity surface fires that limit loss of structures or ecosystem function

The following management approaches within the conservation management area plan direction emphasize the restoration goal in these areas through the use of fuelbreaks and the focus on aspen regeneration:

- Within a 660-foot corridor on each side of the roads approved in travel management plans, the restoration goal would be to mechanically restore ponderosa pine, dry mixed conifer, meadows, encroached grasslands, and woodland ecotypes. The purpose of this restoration would be to create shaded fuelbreaks to use as holding features during the management of planned and unplanned ignitions, to allow safe ingress and egress for the public and Forest Service personnel, and to create fuelwood opportunities for the public.
- Restoration activities would focus on aspen regeneration through thinning and planned and unplanned fire.

Issue C: Provide for Watershed Health

There is an objective to annually improve water resource features by implementing at least 2 to 5 projects with this emphasis, focused in proposed restoration and conservation management areas. Under infrastructure improvements, 3 to 5 miles of system roads or unauthorized routes would be relocated or improved annually to protect ecosystems and watersheds.

Issue D: Address Conflicts between Recreation and Multiple Uses

Objectives for dispersed recreation under alternative C include evaluating and addressing up to 10 percent of forestwide trail system mileage for need, condition, use, relevance, and sustainability during the life of the plan. This increased emphasis on the trail system should provide increased user satisfaction with the recreation opportunities focus on the user conflicts that exist across the Cibola by evaluating the use and relevance of the trail.

Issue E: Consider New Wilderness and Management Areas

Alternative C recommends 24,265 acres within the Magdalena and Mountainair Districts for wilderness designation. The additions are mostly concentrated in the Magdalena Ranger District, specifically around expanding the Apache Kid Wilderness (Apache Kid Wilderness expansion 1, 2, 3, 5) by 22,945 acres. Additionally, this alternative proposes expanding the Manzano Wilderness by 1,320 acres (Manzano Wilderness expansion 2, 3, 4, and 5) on the Mountainair Ranger District. These recommended wilderness management areas are contiguous to existing designated wilderness areas (not separated by more than a mile of level 2 road in the motor vehicle use map) and contain high wilderness characteristics (overall H and H+ evaluation finding) with no existing or future uses incompatible with managing for recommended wilderness. The criteria for recommended wilderness in alternative C also followed the intent of the alternative in that recommended wilderness areas shall not conflict with the proposed restoration management areas.

Alternative C also proposes conservation management areas which have the purpose of protecting and enhancing values such as uninterrupted wildlife habitat, solitude, and scenic integrity and provide socioeconomic opportunities that emphasize backcountry and primitive recreation. Locations for these management areas are remote with primarily nonmotorized access along with opportunities for solitude within an expansive terrain absent of significant human development. The setting in these areas provide solitude, scenic views, and access to unique features and places including culturally significant areas for local tribes. As well, these areas contain a standard that prohibits the construction of new roads or motorized trails within the area to emphasize primitive recreation opportunities.

The criteria for determination of these conservation management areas is based on areas from the wilderness evaluation process that contain high wilderness characteristics, are not contiguous to existing designated wilderness, and are over 10,000 acres in size for manageability of quality backcountry recreation opportunities and quality restoration scales. These large areas (over 10,000 acres) are proposed to be managed to both preserve primitive backcountry character and use while still allowing restoration goals using mechanical techniques generally prohibited in recommended wilderness. See appendix C for further explanation of the wilderness process.

Alternative D – Backcountry Uses

Alternative D responds to public comments that forest management should emphasize natural processes and include more recommended wilderness areas. This alternative has an emphasis on natural processes with a reliance on managed wildfire to move vegetation toward desired conditions. It also emphasizes backcountry and primitive recreation by decreasing the intensity of restoration treatments. The intent is to provide more solitude, remoteness, and primitive recreation with more emphasis on dispersed recreation than managed recommendation. It includes the most area of recommended wilderness management areas amongst the action alternatives.

Issue A: Support Cultural and Traditional Landscapes and Uses

The majority of plan direction associated with this issue is common to alternatives B and C. However, the proposed grazing allotments would stay at current levels. This is due to the potential for designation of the recommended wilderness areas, upon which designation would have limiting effects on future grazing allotments within these areas. The proposed amount of fuelwood under alternative D through the issuance of fuelwood permits would be the same as alternatives A and B at 9,000 to 12,000 cords annually. Rural historic communities utilize fuelwood for economic purposes along with heating their homes across the Cibola.

Issue B: Restore Resilient Ecosystems

Alternative D predominantly uses prescribed fire and managed wildfires to move toward vegetative desired conditions. It also maintains the acres treated as under alternatives A and B. Mechanical treatments would only be used in limited situations to prepare locations to facilitate fire such as for containment line preparation, to protect structures and facilities within and adjacent to wildland urban interface areas, and cultural sites.

Objectives are on an annual basis for mechanical thinning, prescribed burns, and managed wildfire:

- mechanically treat 2,000 to 5,000 acres of highly departed areas (ponderosa pine and dry mixed conifer frequent fire types)
- prescribe burn 4,200 to 12,000 acres to reduce wildfire risk and restore conditions
- manage 2,200 to 5,500 acres of naturally ignited wildfires

Issue C: Provide for Watershed Health

Under alternative D, there is an objective to annually improve water resource features by implementing at least 2 to 5 projects with this emphasis, focused in proposed restoration and conservation management areas. Under infrastructure improvements, 1 to 3 miles of system roads or unauthorized routes would be relocated or improved annually to protect ecosystems and watersheds.

Issue D: Address Conflicts between Recreation and Multiple Uses

Objectives for dispersed recreation include evaluating and addressing up to 15 percent of forestwide trail system mileage for need, condition, use, relevance, and sustainability during the life of the plan. This is the most amount proposed among the action alternatives due to the focus on dispersed recreation under alternative D.

Issue E: Consider New Wilderness and Management Areas

Alternative D recommends 203,117 acres within all four districts for wilderness designation. The majority of these additions are concentrated within the Magdalena Ranger District (166,025 acres) with proposed expansions of the Apache Kid Wilderness and Withington Wilderness and areas in the Datil, Bear, and Magdalena Mountains. Additionally, this alternative proposes expanding the Manzano Wilderness by 7,054 acres (Manzano Wilderness expansion 1, 2, 3, 4, and 5) and adding an area in the Gallinas Mountains (2,410 acres) on the Mountainair Ranger District. Additional areas of recommended wilderness management areas are proposed within the Mt. Taylor Ranger District (27,348 acres) and one area within the Sandia Ranger District (281 acres). These recommended wilderness management areas are stand alone and contiguous to existing designated wilderness areas that contain moderate to high wilderness characteristics (overall M, M+, H, and H+ evaluation findings), regardless of existing conflicts.

The designated areas analysis in this draft environmental impact statement discusses how these incompatible uses to managing as recommended wilderness could continue within these areas. However, these incompatible uses were addressed and evaluated during the wilderness inventory and evaluation processes, so there are minimal incompatible uses identified within the recommended wilderness areas proposed in alternative D.

Alternatives Considered But Not Analyzed in Detail

Federal agencies are required by the National Environmental Policy Act to rigorously explore and objectively evaluate reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received during the plan revision process provided suggestions for alternative methods for achieving the purpose and need. Some of these suggestions may have been outside the scope of the plan revision process, already addressed by the alternatives considered in detail, or may be contrary to existing law. A number of alternatives were considered but dismissed from detailed consideration for reasons summarized below.

Alternative to Maintain and Restore Roadless Values and Wilderness Character of Chapter 70 Inventoried Areas not Recommended for Wilderness

Public comments were received regarding maintaining and restoring roadless values and wilderness character of chapter 70 inventoried areas that were not recommended for wilderness. 2012 Forest Service Planning Rule and chapter 70 of the Forest Service Land Management Planning Handbook 1909.12, section 71 outline the intent of the wilderness inventory process:

> “The intent is to identify lands that may be suitable, so that they can be evaluated and to allow for public input and feedback […] Inclusion in the inventory is not a designation that conveys of requires a particular kind of management.”

The purpose of the wilderness evaluation step of the four-step process is to determine if areas in the wilderness inventory have wilderness character. Those not found to have wilderness character are not required to move forward into environmental analysis, per chapter 70, section 72:

> "The Responsible Official is not required to carry all lands evaluated forward for further NEPA analysis as potential recommendations for inclusion in the National Wilderness Preservation System (secs. 73 and 74 of this Handbook)”.

Cibola personnel determined which areas of the wilderness evaluation possessed wilderness character. Those areas were carried forward to the analysis process (described in appendix A). The remaining portions of the wilderness inventory are in conformance with the draft land management plan forestwide plan components.

Alternative that Would Recommend the Citizen's Conservation Proposal in its Entirety

Cibola personnel received the citizen's conservation proposal in September 2015 from a group of supporting organizations. Members of the organizations recommended including their proposal in one or more alternatives in the environmental impact statement for the Cibola land management plan revision. The proposal recommended seven areas for wilderness and a separate Sandia Mountains Outdoor Education and Natural Area. The proposal requested plan components, such as standards and guidelines, to protect the roadless character and natural values of their proposed recommended areas. The plan components were proposed in multiple alternatives, including the preferred alternative.

The entire citizen's conservation proposal as an alternative was considered but not analyzed in detail because it does not fit the criteria outlined in the analysis process including the following: alternative themes and whether or not an area fits the alternative theme as recommended wilderness; quality of wilderness characteristics determined in evaluation (results of phase 2 evaluation); existing uses compatible or incompatible with managing for recommended wilderness; and future management needs compatible or incompatible with managing for recommended wilderness.

However, Cibola personnel did consider the seven recommended areas outlined in the proposal within the required process of identifying and evaluating lands that may be suitable for inclusion in the National Wilderness Preservation System. Portions of the proposal's recommended wilderness areas have been included in one or more of the proposed alternatives that are further analyzed in this document. Portions of the areas proposed in the Magdalena Ranger District are proposed as conservation management areas in the preferred alternative C. Further detail on the evaluation and analysis of wilderness characteristics for areas proposed is summarized in appendix A.

The recommended wilderness section in chapter 3 of the draft plan outlines plan components to protect the roadless character and natural values of recommended wilderness areas to maintain wilderness character.

Cibola personnel considered but did not analyze in detail the Sandia Outdoor Education and Natural Area with the consideration that the intent and purpose behind this type of area is already addressed in forestwide plan components.

Alternative that Would Recommend the Backcountry Wildlife Conservation Area in its Entirety

The Cibola received a proposal for a backcountry wildlife conservation area in the San Mateo Mountains in April 2015 from a group of supporting organizations. The proposal recommended areas within the San Mateo Mountains to be managed for the habitat and hunting access that they provide. Two management zones were proposed, including zone 1 that would be wilderness and recommended wilderness areas and zone 2 that would be backcountry wild. Zone 1 covers the Apache Kid and Withington Wilderness areas as well as the proposed Apache Kid expansion, Withington expansion, and Panther Canyon recommended wilderness areas.

This alternative to consider the backcountry wildlife conservation area in the San Mateo Mountains was considered but not analyzed in detail because the proposed management prescriptions for Zone 1 to not allow mineral extraction is contrary to existing law, the General Mining Act of 1872. As well, the proposed management prescription for zone 1 to not allow timber harvest or gathering of forest products is contrary to the proposed alternative themes. The proposed management prescriptions as written for zone 2 to limit forest and vegetation management is contrary to the proposed alternative themes and is contrary to the proposed restoration area proposed in the San Mateo Mountains. Further, the proposed management prescription for zone 2 to prohibit surface based mineral development is contrary to existing law, the General Mining Act of 1872. The proposed zone 1 from the backcountry wildlife conservation area has been included as proposed conservation management areas in the San Mateo Mountains for the Magdalena District with modifications of the suggested boundaries for transportation and utility infrastructure. Management direction for the conservation management areas is outlined in chapter 3 (management areas) of the draft plan.

Alternative for Communal Grazing Areas

There was a proposal from the Carnue Land Grant-Merced to reactivate a grazing area that would be for goats or small-scale cattle. There was a similar proposal for reactivation of community grazing on the former Gross Kelly allotment. These and several other former allotments on the Cibola have been closed to grazing, in some cases for many decades.

These proposals were not analyzed in detail because grazing could not be authorized through the land management plan; it is authorized through site-specific environmental analysis. Site-specific analysis would be required to reopen historically closed allotments. The analysis would evaluate the livestock class, stocking levels and season of use, needed water developments, fencing and other range improvements, and conflicts with other plan components, such as incompatibility between wild and domestic sheep and bighorn sheep. The analysis would result in an allotment management plan. In some cases, the access and use of these lands has dramatically changed since the areas were closed to grazing. Site-specific environmental analysis to reopen these closed allotments would need to address practicable boundaries for newly permitted grazing and consider current access, developed and undeveloped recreation sites, existing special uses, and transportation and utility infrastructure.

To address the desire to reopen closed allotments the Cibola has included a forestwide guideline within the “Sustainable Rangelands and Livestock Grazing” section of the draft plan applicable to closed allotments that would direct how we would reopen those allotments through site-specific environmental analysis. This guideline that would allow reopening of closed allotments under all alternatives is not tied to a specific management area. This would apply to all closed allotments on the Cibola where there are interested grazing applicants for reopening of a closed allotment.

Alternative Comparison Tables

This section provides a summary comparison of the alternatives. Table 1 summarizes the differences in management direction for resource areas and anticipated outputs that can be compared quantitatively or qualitatively by alternative. Table 2 compares proposed management areas by alternative for the mountain districts. Table 3 is a summary of existing designated areas by mountain district. Table 4 compares the recommended wilderness areas by district and alternative, table 5 provides a total acreage of recommended wilderness by alternative, and table 6 compares socioeconomic characteristics.

Table 1. Summary of resource area objectives by alternative

Objective	Alternative A	Alternative B	Alternative C	Alternative D
Traditional Communities and Uses				
Rural historic communities	Provide 9,000 to 12,000 cords of fuelwood annually through the issuance of fuelwood permits	Provide 9,000 to 12,000 cords of fuelwood annually through the issuance of fuelwood permits	Provide 12,000 to 15,000 cords of fuelwood annually through the issuance of fuelwood permits	Provide 9,000 to 12,000 cords of fuelwood annually through the issuance of fuelwood permits
Water Resources				
Water resource	Annually improve water resource features (for example, riparian areas, springs, streams) or soils by implementing at least 0 to 1 projects annually	Annually improve water resource features (for example, riparian areas, springs, streams) or soils by implementing at least 1 to 2 projects annually	Annually improve water resource features (for example, riparian areas, springs, streams) or soils by implementing at least 2 to 5 projects annually	Annually improve water resource features (for example, riparian areas, springs, streams) or soils by implementing at least 2 to 5 projects annually
Vegetation				
General management of all vegetation types	Mechanically treat 2,000 to 5,000 acres annually of highly departed areas (for example, ponderosa pine and dry mixed conifer in fire-adapted ecosystems)	Mechanically treat 2,000 to 5,000 acres annually of highly departed areas (for example, ponderosa pine and dry mixed conifer in fire-adapted ecosystems)	Mechanically treat 2,800 to 7,000 acres annually of highly departed areas (for example, ponderosa pine and dry mixed conifer in fire-adapted ecosystems)	Mechanically treat 2,000 to 5,000 acres annually of highly departed areas (for example, ponderosa pine and dry mixed conifer in fire- adapted ecosystems)
Infrastructure				
Infrastructure	Relocate, improve, or decommission up to 1 mile annually of system roads or unauthorized routes to protect ecosystems and watersheds.	Relocate, improve, or decommission 1 to 3 miles annually of system roads or unauthorized routes to protect ecosystems and watersheds.	Relocate, improve, or decommission 3 to 5 miles annually of system roads or unauthorized routes to protect ecosystems and watersheds.	Relocate, improve, or decommission 1 to 3 miles annually of system roads or unauthorized routes to protect ecosystems and watersheds.
Sustainable Grazing and Range				

Objective	Alternative A	Alternative B	Alternative C	Alternative D
Sustainable grazing and range	Remove, improve, or reconstruct at least 5 to 10 improvements annually (for example, fences, water developments, cattleguards) that are no longer necessary, in poor condition, or to move toward desired conditions.	Remove, improve, or reconstruct at least 10 to 15 improvements annually (for example, fences, water developments, cattleguards) that are no longer necessary, in poor condition, or to move toward desired conditions.	Remove, improve, or reconstruct at least 15 to 20 improvements annually (for example, fences, water developments, cattleguards) that are no longer necessary, in poor condition, or to move toward desired conditions.	Remove, improve, or reconstruct at least 10 to 15 improvements annually (for example, fences, water developments, cattleguards) that are no longer necessary, in poor condition, or to move toward desired conditions.
Sustainable grazing and range	Animal unit months remain current	Animal unit months increase by 2 percent	Animal unit months increase by 2 percent	Animal unit months remain current
Recreation				
Dispersed recreation	Evaluate and address up to 7 percent of forestwide trail system mileage for need, condition, use, relevance, and sustainability during the life of the plan.	Evaluate and address up to 10 percent of forestwide trail system mileage for need, condition, use, relevance, and sustainability during the life of the plan.	Evaluate and address up to 10 percent of forestwide trail system mileage for need, condition, use, relevance, and sustainability during the life of the plan.	Evaluate and address up to 15 percent of forestwide trail system mileage for need, condition, use, relevance, and sustainability during the life of the plan.
Fire and Fuels				
Fire and fuels	Prescribe burn 3,500 to 10,000 acres annually to reduce wildfire risk and restore conditions.	Prescribe burn 4,200 to 12,000 acres annually to reduce wildfire risk and restore conditions.	Prescribe burn 4,900 to 14,000 acres annually to reduce wildfire risk and restore conditions.	Prescribe burn 4,200 to 12,000 acres annually to reduce wildfire risk and restore conditions.
Fire and fuels	Manage 2,000 to 5,000 acres annually of managed wildfires.	Manage 2,200 to 5,500 acres annually of managed wildfires.	Manage 2,400 to 6,000 acres annually of naturally ignited wildfires.	Manage 2,200 to 5,500 acres annually of managed wildfires.

Table 2. Comparison of management areas by alternative for the four mountain districts

Unit and Area Name	Alternative A	Alternative B	Alternative C	Alternative D
Mt. Taylor District				
Mount Taylor	0 acres	23,352 acres	0 acres	0 acres
Guadalupe	0 acres	14,988 acres	0 acres	0 acres
Fort Wingate	0 acres	2,214 acres	0 acres	0 acres
Little Water Canyon	910 acres (proposed RNA)	4,778 acres	0 acres	0 acres
Restoration	0 acres	0 acres	180,073 acres	0 acres
Conservation	0 acres	0 acres	14,988 acres	0 acres

Unit and Area Name	Alternative A	Alternative B	Alternative C	Alternative D
Eligible wild and scenic rivers (miles in length, ¼ mile corridor on each side of centerline/high water line)	Agua Remora 1.9 miles, Little Water Canyon 2 miles, Water Canyon #1 2.2 miles, and Rinconada 2.7 miles	Same as alternative A	Same as alternative A	Same as alternative A
Magdalena District				
Silver Hill Dark Skies	0 acres	43 acres	0 acres	0 acres
Pueblo Migrations	0 acres	8,703 acres	0 acres	0 acres
Restoration	0 acres	0 acres	57,840 acres	0 acres
Conservation	0 acres	0 acres	21,559 acres	0 acres
Eligible wild and scenic rivers (miles in length, ¼ mile corridor on each side of centerline/high water line)	West Red Canyon 7.7 miles	Same as alternative A	Same as alternative A	Same as alternative A
Mountainair District				
Fourth of July Canyon	0 acres	227 acres	0 acres	0 acres
Jumanos Pueblos	0 acres	37,853 acres	0 acres	0 acres
Cement Springs	0 acres	715 acres	0 acres	0 acres
Restoration	0 acres	0 acres	44,475 acres	0 acres
Conservation	0 acres	0 acres	0 acres	0 acres
Eligible wild and scenic rivers (miles in length, ¼ mile corridor on each side of centerline/high water line)	Tajique Canyon 3.9 miles	Same as alternative A	Same as alternative A	Same as alternative A
Sandia District				
Las Huertas Canyon	0 acres	5,747 acres	0 acres	0 acres
Restoration	0 acres	0 acres	35,760 acres	0 acres
Conservation	0 acres	0 acres	0 acres	0 acres
Eligible wild and scenic rivers (miles in length, ¼ mile corridor on each side of centerline/high water line)	Las Huertas Creek 3.8 miles	Same as alternative A	Same as alternative A	Same as alternative A

Table 3. Comparison of existing designated areas by alternative for the four mountain districts

Type of Designated Area	Alternative A	Alternative B	Alternative C	Alternative D
Existing designated wilderness	Magdalena: Apache Kid Wilderness 44,626 acres, Withington Wilderness 19,000 acres Mountainair: Manzano Wilderness 36,875 acres Sandia: Sandia Wilderness 37,877 acres Mountain districts total: 138,378 acres	Same as alternative A	Same as alternative A	Same as alternative A
Inventoried roadless areas	Mt. Taylor: 5 inventoried roadless areas, 33,288 acres Magdalena: 8 inventoried roadless areas, 205,855 acres	Same as alternative A	Same as alternative A	Same as alternative A
Scenic byways	Route 66 7 miles, El Camino Real 0 miles, Turquoise Trail (including Sandia Crest) 14.2 miles, Salt Missions Trail 11 miles, Abo Pass Trail 0 miles, Trail of the Ancients 2.16 miles	Same as alternative A	Same as alternative A	Same as alternative A
Continental Divide National Scenic Trail	45 miles	Same as alternative A	Same as alternative A	Same as alternative A
Bernalillo Watershed Research Natural Area (Sandia Ranger District)	299 acres juniper grassland and 731 acres semi-desert grassland	Same as alternative A	Same as alternative A	Same as alternative A
Sandia Cave National Historic Landmark (Sandia Ranger District)	160 acres	Same as alternative A	Same as alternative A	Same as alternative A
Department of Defense Kirtland Air Force Base and Department of Energy Withdrawal Area (Sandia Ranger District)	Department of Defense Kirtland Air Force Base: 15,891 acres Department of Energy, Sandia Laboratories: 4,595 acres	Same as alternative A	Same as alternative A	Same as alternative A
T'uf Shur Bien Preservation Trust Area (Sandia Ranger District)	9,890 acres	Same as alternative A	Same as alternative A	Same as alternative A
Langmuir Research Site and Magdalena Ridge Observatory (Magdalena Ranger District)	29,693 acres	Same as alternative A	Same as alternative A	Same as alternative A

Table 4. Acres of recommended wilderness by district and alternative

Unit and Recommended Wilderness Area Name	Alternative A	Alternative B	Alternative C	Alternative D
Mt. Taylor District				
Hogback	0	0	0	5,564
Guadalupe	0	0	0	14,988
Mount Taylor	0	0	0	475
Little Water Canyon	0	0	0	6,321
TOTAL	0	0	0	27,348
Magdalena District				
Datil Mountains Wilderness	0	10,179	0	14,052
Datil Mountains 1	0	0	0	18,350
Magdalena Mountains 1	0	3,057	0	4,742
Magdalena Mountains 2	0	0	0	1,652
Panther Canyon	0	11,164	0	27,598
Apache Kid Wilderness Expansion 1	0	11,328	11,328	32,819
Apache Kid Wilderness Expansion 2	0	5,497	5,497	22,244
Apache Kid Wilderness Expansion 3	0	2,595	2,595	4,214
Apache Kid Wilderness Expansion 4	0	0	0	3,654
Apache Kid Wilderness Expansion 5	0	3,525	3,525	12,878
Apache Kid Wilderness Expansion 6	0	0	0	181
Bear Mountains 1	0	0	0	1,713
Bear Mountains 2	0	0	0	2,307
Bear Mountains 3	0	2,323	0	3,154
Withington Wilderness Expansion 1	0	0	0	20
Withington Wilderness Expansion 2	0	0	0	5
Withington Wilderness Expansion 3	0	0	0	55
Withington Wilderness Expansion 4	0	0	0	6
Withington Wilderness Expansion 5	0	0	0	48
Withington Wilderness Expansion 6	0	3,567	0	10,052
Withington Wilderness Expansion 7	0	0	0	81

Unit and Recommended Wilderness Area Name	Alternative A	Alternative B	Alternative C	Alternative D
Spruce Park	0	0	0	6,198
TOTAL	0	52,235	22,945	166,025
Mountainair District				
Manzano Wilderness Expansion 1	0	1,224	0	5,734
Manzano Wilderness Expansion 2	0	364	364	364
Manzano Wilderness Expansion 3	0	353	353	353
Manzano Wilderness Expansion 4	0	357	357	357
Manzano Wilderness Expansion 5	0	246	246	246
Gallinas	0	0	0	2,410
TOTAL	0	2,544	1,320	9,464
Sandia District				
Sandia Wilderness Expansion 2	0	0	0	281
TOTAL	0	0	0	281

Table 5. Acres of recommended wilderness by action alternative

Ranger District	Alternative B	Alternative C	Alternative D
Mt. Taylor	0	0	27,348
Magdalena	53,235	22,945	166,025
Mountainair	2,544	1,320	9,463
Sandia	0	0	281
TOTAL	55,779	24,265	203,117

Table 6. Socioeconomic comparison of alternatives

Socioeconomic Characteristic	Alternative A (No Action)	Alternative B (Unique Mgmt. Areas)	Alternative C Proposed Action	Alternative D (Backcountry)
Total annual jobs (estimated)	1,102	1,104	1,142	1,102
Total annual income (estimated)	$45.5 million	$45.6 million	$47.6 million	$45.5 million
PTSQ* objective	12.9 MMBF (3.3 MMCF)	12.9 MMBF (3.2 MMCF)	16.4 MMBF (4.2 MMCF)	12.6 MMBF (3.2 MMCF)
PWSQ* objective	3.5 MMCF	3.5 MMCF	4.4 MMCF	3.4 MMCF
Livestock grazing (average animal unit months)	33,309	33,996	33,396	33,309

*Projected Timber Sale Quantity (PTSQ) and Projected Wood Sale Quantity (PWSQ) calculation of annual numbers based on first decade.
MMBF – million board feet, MMCF– million cubic feet

Table 7 through table 10 provide a summary of estimated annual acreages of mechanical treatment, prescribed fire, and managed wildfire under each alternative. Estimated annual acreages of management activity by vegetation type are based on the ranges of proposed activity in the objectives by alternative and are proportional to respective Cibola acreages. For example, mechanical treatment and prescribed fire are proposed only for Ponderosa Pine Forest and Dry Mixed Conifer,[1] and their activity acreages reflect their relative abundance on the Cibola which is 3 to 1. Managed wildfire acreages for all vegetation types are also distributed proportionally among all vegetation types based on the relative abundance of each vegetation type.

Table 7. Estimated annual acreage of mechanical treatment, prescribed fire, and managed wildfire under alternative A.

Vegetation type	Mechanical treatment	Prescribed fire	Managed wildfire
Ponderosa Pine Forest	1,500 to 3,750	2,625 to 7,500	564 to 1,411
Dry Mixed Conifer	500 to 1,250	875 to 2,500	195 to 487
All others combined	0	0	1,241 to 3,102
Total	2,000 to 5,000	3,500 to 10,000	2,000 to 5,000

[1] Dry Mixed Conifer is also referred to as the Mixed Conifer Frequent Fire vegetation type.

Table 8. Estimated annual acreage of mechanical treatment, prescribed fire, and managed wildfire under alternative B.

Vegetation type	Mechanical treatment	Prescribed fire	Managed wildfire
Ponderosa Pine Forest	1,500 to 3,750	3,150 to 9,000	621 to 1,552
Dry Mixed Conifer	500 to 1,250	1,050 to 3,000	214 to 536
All others combined	0	0	1,365 to 3,412
Total	2,000 to 5,000	4,200 to 12,000	2,200 to 5,500

Table 9. Estimated annual acreage of mechanical treatment, prescribed fire, and managed wildfire under alternative C.

Vegetation type	Mechanical treatment	Prescribed fire	Managed wildfire
Ponderosa Pine Forest	2,100 to 5,250	3,675 to 10,500	677 to 1,693
Dry Mixed Conifer	700 to 1,750	1,225 to 3,500	234 to 584
All others combined	0	0	1,489 to 3,723
Total	2,800 to 7,000	4,900 to 14,000	2,400 to 6,000

Table 10. Estimated annual acreage of mechanical treatment, prescribed fire, and managed wildfire under alternative D.

Vegetation type	Mechanical treatment	Prescribed fire	Managed wildfire
Ponderosa Pine Forest	1,500 to 3,750	3,150 to 9,000	621 to 1,552
Dry Mixed Conifer	500 to 1,250	1,050 to 3,000	214 to 536
All others combined	0	0	1,365 to 3,412
Total	2,000 to 5,000	4,200 to 12,000	2,200 to 5,500

Chapter 3. Affected Environment and Environmental Consequences

Introduction

This chapter summarizes the physical, biological, social, and economic environments of the planning area and the potential environmental consequences that may occur on those environments by implementing each alternative. It also presents the scientific and analytical basis for the comparison of alternatives presented in chapter 2. Where indicated, more detailed information, including methodology, assumptions, and effects analyses not discussed in the appendix B (description of analysis), can be found in the planning record located at the Cibola National Forest and National Grasslands Supervisor's Office, Albuquerque, New Mexico.

The Relationship between Land Management Plans and Site-Specific Activities

The focus of this analysis is to examine the implications or longer-term environmental consequences of managing the Cibola under the programmatic framework provided by the draft land management plan and proposed alternatives. Land management plans do not authorize, fund, or carry out any project or activity described in the effects analyses. Instead, they provide a programmatic framework that guides site-specific actions that may be carried out in the future.

Because a land management plan does not authorize or mandate any site-specific projects or activities (including ground-disturbing actions), there can be no direct effects. The draft land management plan sets the stage for what future management actions are needed to achieve desired outcomes (for example, desired conditions and objectives), and provide the sideboards (such as suitability, standards, and guidelines) under which future activities may occur to manage risks to ecological, social, and economic environments. The draft land management plan also identifies potential management approaches that may be used to help achieve desired conditions. To actually plan and proceed with a site-specific project, project-level planning, environmental analysis, and decisions must occur.

Science and Assumptions Used in the Environmental Analyses

During development of the environmental analyses that follow, the Cibola planning team used the best available scientific information, which is documented in the planning record. The environmental analyses focus on the needs for changing the existing plan and the significant issues identified through the scoping process.

The discussions in chapter 3 refer to the potential for consequences to occur, realizing they are only estimates in many cases. To estimate the consequences of alternatives at the programmatic plan level, we must assume the kinds of resource management activities allowed under the prescriptions will occur to the extent necessary to move toward or achieve the objectives of each alternative. In many cases, the nature of the consequences are similar across the Cibola, but the magnitude of the consequences vary by the difference in plan objectives and specific plan components for different management areas by alternative.

Several assumptions were made in the analyses of alternatives:

- The Cibola National Forest draft land management plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carry out any project or activity (including ground-disturbing actions). As a result, it does not result in direct effects. However, there may be implications or longer term indirect or cumulative environmental consequences from managing the forests under this programmatic framework.
- Before any ground-disturbing actions take place, they must be authorized in a subsequent site-specific environmental analysis. Therefore, none of the alternatives would cause unavoidable adverse impacts or an irreversible or irretrievable commitment of resources.
- The plan decisions (desired conditions, objectives, standards, guidelines, management areas, and monitoring) will be followed when planning or implementing site-specific projects and activities.
- Law, regulation, and policy regulations will be followed when planning or implementing site-specific projects and activities.
- Funding levels will be similar to the past 5 years.
- The planning timeframe for the effects analysis is 10 to15 years; although other timeframes may be specified in the analysis, depending on the resource and potential consequences.
- Monitoring identified in the plan's monitoring chapter will occur.
- The land management plan will be amended, as needed, during the life of the plan.

For the following analysis, all alternatives are evaluated in terms of how well they achieve the same set of desired conditions, regardless of whether the alternative articulates those desired conditions.

Vegetation

Background

Plant communities on the Cibola follow a climatic-elevational gradient from hot, dry, low-elevation desert scrub, shrub, and grassland upward to pinyon-juniper and pine-oak woodlands. Continuing up in elevation, woodlands transition into ponderosa pine and mixed-conifer forests and eventually up to cold, humid, high-elevation spruce-fir forest and montane grassland. Over two-thirds of the area of the Cibola is composed of either pinyon-juniper (PJ) woodlands (42 percent) or ponderosa pine forest (28 percent). The remainder comprises a variety of forest (12 percent), grassland (11 percent), shrubland (4 percent), woodland (2 percent), and riparian (less than 0.5 percent) vegetation types (table 11). In spite of—and because of—their scarcity on the Cibola, riparian areas are extremely important hydrologically (surface-water availability, subirrigation of riparian vegetation) and ecologically (biodiversity, productivity, wildlife habitat). For a more detailed description of each vegetation type, see the draft land management plan.

Table 11. Major vegetation types[2] and system types of the Cibola[3]

Vegetation Type	Vegetation Type Subclass*	System Type	% of Cibola
Spruce-Fir Forest	Spruce-Fir-Lower	Forest	0.40
Spruce-Fir Forest	Spruce-Fir-Upper	Forest	0.08
Wet Mixed Conifer (Mixed Conifer with Aspen)	NA	Forest	2.04
Dry Mixed Conifer (Mixed Conifer Frequent Fire)	NA	Forest	9.74
Ponderosa Pine Forest	Ponderosa Pine/Bunchgrass	Forest	2.10
Ponderosa Pine Forest	Ponderosa Pine/Gambel oak	Forest	26.1
PJ Evergreen Shrub	NA	Woodland	1.40
PJ Woodland	PJ Woodland–Cold	Woodland	13.5
PJ Woodland	PJ Woodland–Mild	Woodland	2.98
PJ Grass	PJ Grass–Cold	Woodland	7.73
PJ Grass	PJ Grass–Mild	Woodland	10.4
Juniper Grass	Juniper Grass–Cold	Woodland	1.18
Juniper Grass	Juniper Grass–Mild	Woodland	4.56
Madrean Pinyon-Oak Woodland	NA	Woodland	1.82
Montane/Subalpine Grassland	NA	Grassland	2.57
Colorado Plateau/Great Basin Grassland	NA	Grassland	1.49
Semi-Desert Grassland	Piedmont Grassland	Grassland	6.64
Semi-Desert Grassland	Sandy Plains Grassland	Grassland	0.42
Mountain Mahogany Mixed Shrubland	NA	Shrubland	1.12
Gambel Oak Shrubland	NA	Shrubland	2.30
Sagebrush Shrubland	NA	Shrubland	0.16
Intermountain Salt Scrub	NA	Shrubland	0.20
Chihuahuan Salt Desert Scrub	NA	Shrubland	0.18
Chihuahuan Desert Scrub	NA	Shrubland	0.04
Sandsage	NA	Shrubland	0.32

NA = Not all vegetation types are divided into subclass

Affected Environment

Summary

Across most of the Cibola, plant community structure and fire regime bear little resemblance to pre-European conditions. Historical timber harvest, livestock grazing (removal of fine fuels), and fire suppression are largely responsible for decreased fire frequency, increased fire severity, larger patch size, and the resulting overall decrease in large trees and increases in early seral (grass/forb/shrub, seedling/sapling) stands and closed canopies in forests and woodlands.

[2] In this document and in the revised Cibola Plan, "vegetation type" is used synonymously with, and as a more generic term for, ecological response unit (ERU)—as used in the Cibola assessment (USDA Forest Service 2015a) —and potential natural vegetation type (PNVT) to highlight the importance of using the finest-scale data available (site-specific Terrestrial Ecological Unit Inventory) when planning and implementing projects.

[3] Riparian vegetation is addressed in "Water Resources" section.

In shrublands and grasslands, decreased fire frequency facilitates tree encroachment and the corresponding decrease in patch size. Three riparian vegetation types are at risk from an invasive species (saltcedar), while threats from forest insects and disease are limited primarily to Douglas-fir and pinyon pine. Additionally, ecosystems over most of the area of the Cibola are projected to be moderately vulnerable (57 percent), highly vulnerable (32 percent), or very highly vulnerable (5 percent) to climate change (Triepke et al. 2014).[4]

Overall Vegetation Structure

Methodology

Overall vegetation structure was analyzed using mapping and ecosystem modeling for current conditions and future (15, 100, 1000 year) trends for major Cibola vegetation types based on data sources of the Forest Service Southwestern Region and modeled using the Vegetation Dynamics Development Tool (VDDT) (ESSA 2006). The current condition of a vegetation type is compared to its respective reference condition under the natural range of variation.[5] This comparison examines the forestwide proportion of each seral stage ("state") under current conditions relative to its respective proportion under reference conditions. Reference conditions in this assessment (based on Wahlberg et al. 2015) were derived from multiple sources including research (dendrochronology, stand reconstruction, etc.), empirical data, and state-and-transition models.

To determine the percentage of departure from reference condition for a vegetation type, the vegetation structural class within each vegetation type is placed into a successional class structure category (state) based on the information in the reference condition model being used for the evaluation (Weisz et al. 2009). A comparison is then made of the current percentage to the reference percentage for each state within the model. The lesser of these two values for each state represents the "amount in common" between current conditions and reference conditions for each state. The sum of these lesser values is subtracted from 100 percent, providing an overall departure rating (0 to 100 percent). These ratings are grouped into three departure categories: low (0 to 33 percent), moderate (34 to 66 percent), and high (67 to 100 percent). For example, the Wet Mixed Conifer (Mixed Conifer with Aspen) vegetation type has seven model states[6] identified (table 12). The sum of the lesser values for the seven states is 38 percent. Therefore, the departure rating is 100 percent minus 38 percent equals 62 percent (moderate departure). Current and projected departures from reference and desired conditions were calculated using this method for each vegetation type modeled in VDDT.

[4] For complete assessment of the status, risks, and trends of vegetation characteristics (overall structure, understory structure, species composition, patch size, coarse woody material, snags, fire regime, invasive plant species, climate, and forest insects and disease) for each vegetation type, see the Cibola assessment (USDA Forest Service 2015a).

[5] The natural range of variation refers to the spatial and temporal variation in ecosystem characteristics under historic disturbance regimes during a reference period. The reference period considered typically includes the full range of variation produced by dominant natural disturbance regimes, often several centuries, for such disturbances as fire and flooding and also includes short-term variation and cycles in climate.

[6] Seedlings and saplings are trees less than 5 inches in diameter at breast height, small trees are 5 to 9.9 inches in diameter at breast height, medium trees are 10 to 19.9 inches in diameter at breast height, and large trees are more than 20 inches in diameter at breast height. The terms "open" and "closed" describe canopy cover—under 30 percent and over 30 percent, respectively. The terms "tolerant" and "intolerant" refer to species that are tolerant (for example, spruce, fir) or intolerant (for example, ponderosa pine) of shade; "mixed-tolerant" refers to species intermediate in shade tolerance (for example, Douglas-fir).

Table 12. Calculation of vegetation structure departure. This example uses model states under reference and current conditions for the Mixed Conifer with Aspen vegetation type. The lesser of the two values from each model state are used to calculate departure.

Model State	Reference	Current	Lesser Value
Grass/ Forb/ Shrub	1%	6%	1%
Aspen/ Mixed-deciduous (all sizes, open and closed)	21%	8%	8%
Seedling/ Sapling/ Small (intolerant, open)	0%	1%	0%
Seedling/ Sapling/ Small (intolerant, closed)	0%	35%	0%
Seedling/ Sapling/Small (tolerant/ mixed-tolerant) and Medium (closed)	29%	47%	29%
Medium (intolerant, open)	0%	2%	0%
Large (tolerant and intolerant, closed, single- and multi-storied)	49%	0%	0%
Sum of lesser values (departure %)	NA	NA	38%
Departure value (100% − sum of lesser values)	NA	NA	62%
Departure category	NA	NA	Moderate

NA = not applicable

Trends were assessed based on the difference between current or future conditions and the reference or desired condition. Forest Service mid-scale mapping was used to depict current condition (Mellin et al. 2008). The Forest Vegetation Simulator (FVS) (Dixon 2002) was used to characterize the effects of natural growth on the ecosystem structure. For the forest and woodland vegetation types where data and adequate models existed, VDDT was then used to simulate stand structure 15, 100, and 1000 ears into the future under current (alternative A) and proposed (alternatives B, C, D) management.[7] These models are based not only on current vegetation structure, but also on how alternative-specific management (acres of prescribed fire, thinning, wildfire, restocking) and subsequent disturbances (insects, disease) will affect future vegetation structure. Trend was not calculated for vegetation types whose Cibola acreages were too small to adequately assess.

The estimated life of the plan (all alternatives) is expected to be about 15 years, hence, the "+15 year" projection. The longer projections of "+100 years" and "+1,000 years" may seem far-reaching, but they illustrate how a particular management scenario may trend over the long term, as short-term (15 year) projections often show little change by alternative. In fact, a projection of 1,000 years may only reflect 2 or 3 lifespans of a tree, and it may take that much time, if not longer, for projected plant community dynamics to stabilize.

[7] Based on management activity from 1997 to 2012. The Cibola shifted emphasis from producing and selling timber products to wildlife habitat management and restoration in 1996. (See Cibola Assessment Volume II, Timber and Special Forest Products, Background.)

Desired conditions are plan components and, although generally similar to reference conditions, they may differ from reference conditions because they account for contemporary considerations (wildland-urban interface, climate change, etc.) and differences among plan alternatives. For example, management areas are often identified because they have different desired conditions from forestwide desired conditions or from other management areas. In the Cibola plan, however, desired conditions for vegetation structure are similar across all alternatives; therefore, current departure from desired conditions is similar across all alternatives, but projected departures differ because management objectives differ by alternative.

Current and Projected Condition

For each major vegetation type, current and projected departures from reference conditions and desired conditions (table 16) were calculated. [8,9,10] All vegetation types are either moderately or highly departed except for Mountain Mahogany/Mixed Shrubland, Montane/Subalpine Grassland, and Semi-Desert Grassland. A departure rating of "low" is considered to be within reference or desired conditions and not at risk.

Understory Structure

While the tree overstory tends to be the dominant characteristic of overall stand structure of forests and woodlands, understory structure is an especially important characteristic of shrublands and grasslands. Litter cover and plant basal cover (Terrestrial Ecological Unit Inventory data) were used to indicate departure of understory structure from reference conditions. While understory structure is not departed for forest or woodland vegetation types, most grassland and shrubland vegetation types are either moderately or highly departed (table 13).

Species Composition

The understory species composition of grassland and shrubland vegetation types is used to determine seral condition (USDA Forest Service 1986b) and was used to indicate current species composition (Terrestrial Ecological Unit Inventory data) departure from reference condition. About half of the vegetation types assessed (Colorado Plateau/Great Basin Grassland, Intermountain Salt Scrub, Montane/Subalpine Grassland, Riparian, Sagebrush Shrubland) are moderately or highly departed and considered to be at risk.

Patch Size

A "patch" is a contiguous area of the same system type in the same structural state. Patch size plays a significant role in wildfire behavior. As previously mentioned, historical timber harvest and fire suppression are largely responsible for decreased fire frequency, increased fire severity, and an increase in closed canopies across Rocky Mountain forests (Schoennagel et al. 2004). These changes, where combined with uncharacteristically large patches of contiguous tree canopies, set the stage for insect and disease outbreaks and uncharacteristically large, severe wildfires.

[8] Departure figures are rounded to nearest whole integer.
[9] Acreages used in VDDT modeling were the midpoint of the range of acres (mechanical treatment, prescribed fire, wildfire) in Objectives Summary (table 2).
[10] Detailed descriptions of seral states and their respective proportions on the Cibola are contained in appendix B.

The same phenomena responsible for increasing patch size of fire-adapted forests and woodlands (removal of fine fuels, fire suppression) are responsible for decreasing patch size of shrublands and grasslands due to tree encroachment. Under historic fire regimes, trees establishing in a shrubland or grassland would have been periodically killed by wildfire, maintaining these historically treeless system types.

All Cibola forest and woodland types are currently highly departed from reference conditions because of uncharacteristically large patch size and are considered to be at high risk (table 13). In contrast, all grassland and most shrubland system types are highly departed because of small patch size and considered to be at high risk (Gambel Oak Shrubland and Sandsage vegetation types are at moderate risk).

Snags and Coarse Woody Material

Snags (standing dead trees) and coarse woody material (downed wood) serve important ecological functions in forests and woodlands. Both provide wildlife habitat and contribute to the formation of soil organic matter. Coarse woody material also helps to reduce soil erosion by shielding the soil surface from raindrop impact and interrupting rill and sheet erosion. Snags and coarse woody material are generally at desirable levels (table 13) across the Cibola.

Fire Regime

Fire regime comprises fire return interval and fire severity type. On the Cibola, fire return interval has increased dramatically for most vegetation types, and in many cases, fire severity type has changed as well. All vegetation types are considered to be highly departed from reference conditions and at high risk except for Wet Mixed Conifer and PJ Evergreen Shrub which are considered to be moderately departed from reference conditions (overall fire return interval is similar to reference conditions, but severity class has shifted to mostly non-lethal) and at moderate risk (table 13).

Climate

Climate change is being addressed at all levels in the Forest Service (Peterson et al. 2011, USDA Forest Service 2011a), as well as outside of the Forest Service at a global scale (IPCC 2007). At the regional and forest scales, the Forest Service is working with other agencies and scientists to develop strategies for addressing climate change (USDA Forest Service 2010a, Triepke et al. 2014). The climate change vulnerability assessment (Triepke et al. 2014) was used to assess the potential vulnerability of ecosystems of the southwestern U.S.—and the Cibola specifically—to climate change. All of the Cibola's vegetation types are moderately or highly vulnerable to climate change (table 13).

Two key strategies for addressing climate change include "mitigation" and "adaptation." Mitigation includes strategies to reduce greenhouse gas sources and emissions and enhance greenhouse gas sinks. It is best addressed at a much larger scale than the land management plan level. Adaptation relates to the ability of a system to adjust to climate change, to be resistant and resilient to potential damages, to take advantage of opportunities, or to cope with consequences. Adaptation is addressed at the plan level in the forestwide plan components of all alternatives. Additionally, specific management recommendations have been crafted for each vegetation type based on their specific vulnerabilities to climate change and ecological needs (see Appendix B - Cibola National Forest Climate Change Vulnerability Analysis (CCVA) – Synthesis).

Forest Insects and Disease

Insects and disease are integral components of forest and woodland ecosystems. Often there are numerous positive impacts of insects and disease on the forest ecosystem such as creating small openings, increasing biodiversity, enhancing nutrient cycling, providing habitat and food sources for animals, and many other ecologically significant benefits. However, under severe disease infection levels or episodic outbreaks of insects, their effects are more evident, sometimes negative, and cause greater forest change. With the exception of white pine blister rust, the insects and diseases on the Cibola that are often considered pests are native organisms that have long been part of the ecosystem and have evolved with their plant hosts. However, as patch size and stocking density have increased since reference conditions, so have the continuity and severity of infestations, and consequently, fire size and severity. Except for Juniper Grass Woodland, all of the Cibola's forests and woodlands are at moderate or high risk (table 13).

Table 13. Status summary of ecosystem characteristics for the Cibola's major vegetation types

Vegetation Type	Overall Structure	Understory Structure	Species Composition	Coarse Woody Material	Snags ≥8 in. DBH[11]	Snags ≥18 in. DBH	Fire Regime	Patch Size[12]	Climate	Forest Insects & Disease
Chihuahuan Desert Scrub	Not at risk	Not at risk	Not at risk	NA	NA	NA	Not assessed or unknown	High risk, Smaller	High risk	NA
Chihuahuan Salt Desert Scrub	High risk	High risk	Not at risk	NA	NA	NA	Not assessed or unknown	High risk, Smaller	High risk	NA
Colorado Plateau/Great Basin Grassland	Moderate risk	Moderate risk	High risk	NA	NA	NA	High risk	High risk, Smaller	High risk	NA
Gambel Oak Shrubland	Moderate risk	Moderate risk	Not at risk	NA	NA	NA	High risk	Moderate risk, Larger	High risk	NA
Intermountain Salt Scrub	High risk	High risk	High risk	NA	NA	NA	Not assessed or unknown	High risk, Smaller	High risk	NA
Juniper Grass	Moderate risk	Not at risk	NA	Not at risk	Not at risk	Not at risk	High risk	High risk, Larger	Moderate risk	Not at risk
Madrean Pinyon-Oak Woodland	High risk	Not at risk	NA	Not at risk	Not at risk	Moderate risk	High risk	High risk, Larger	Moderate risk	High risk
Dry Mixed Conifer	High risk	Not at risk	NA	Not at risk	Not at risk	Not at risk	High risk	High risk, Larger	High risk	High risk
Wet Mixed Conifer	Moderate risk	Not at risk	NA	Not at risk	Not at risk	Not at risk	Moderate Risk	High risk, Larger	High risk	High risk
Montane/Subalpine Grassland	Not at risk	Moderate risk	High Risk	NA	NA	NA	High risk	High risk, Smaller	High risk	NA
Mountain Mahogany Mixed Shrubland	Not at risk	Not at risk	Not at risk	NA	NA	NA	High risk	High risk, Larger	Moderate risk	NA

[11] Diameter at breast height
[12] Larger means patch size increased; smaller means patch size decreased since the reference period.

Vegetation Type	Overall Structure	Understory Structure	Species Composition	Coarse Woody Material	Snags ≥8 in. DBH[11]	Snags ≥18 in. DBH	Fire Regime	Patch Size[12]	Climate	Forest Insects & Disease
PJ Evergreen Shrub	High risk	Not at risk	NA	Not at risk	Not at risk	Not at risk	Moderate risk	High risk, Larger	Moderate risk	High risk
PJ Grass	Moderate risk	Not at risk	NA	Not at risk	Not at risk	Moderate risk	High Risk	High risk, Larger	High risk	High risk
PJ Woodland	Moderate risk	Not at risk	NA	Not at risk	Not at risk	Not at risk	High Risk	High risk, Larger	Moderate risk	High risk
Ponderosa Pine Forest	High risk	Not at risk	NA	Not at risk	Not at risk	Not at risk	High Risk	High risk, Larger	High risk	Moderate risk
Sagebrush Shrubland	High risk	High risk	High Risk	NA	NA	NA	High Risk	High risk, Smaller	High risk	NA
Sandsage	Not at risk	Not at risk	Not at risk	NA	NA	NA	Not assessed or unknown	Moderate risk, Smaller	High risk	NA
Semi-Desert Grassland	Not at risk	Not at risk	Not at risk	NA	NA	NA	High Risk	High risk, Smaller	Moderate risk	NA
Spruce-Fir Forest	Moderate risk	Not at risk	NA	Not at risk	Not at risk	Moderate risk	High Risk	High risk, Larger	High risk	High Risk

Environmental Consequences[13]

This section analyzes the environmental consequences of the land management plan proposed treatment objectives outlined by plan alternatives on vegetation within primarily the Ponderosa Pine and Dry Mixed Conifer vegetation types and in areas of special designations, such as proposed restoration management areas. This section serves to examine and compare the four proposed alternatives: a no-action alternative (alternative A), which reinstates the 1985 plan without major revisions; unique management areas alternative (alternative B), which proposes a mix of treatments outside of place based management areas; the proposed action (alternative C), which proposes a mix of treatments primarily within purpose based restoration management areas; and backcountry alternative (alternative D), which relies on natural processes such as fire. Plan alternatives were designed to move the condition of highly departed vegetation types toward desired conditions to increase ecosystem function and resiliency.

The land management plan objectives determine the number of treatment acres needed to move departed vegetation types toward desired conditions over the 15-year planning cycle. Projected acreages of vegetation management over the life of the plan differ slightly by alternative. This activity will be concentrated in the Cibola's two fire-adapted forest vegetation types— Ponderosa Pine (table 14) and Dry Mixed Conifer (table 15). The tables divide treatments into mechanical methods and fire categories for the midpoint of the proposed range for each. Mechanical methods would incorporate mechanized treatments, hand-based treatments, or other methods that are effective for restoration. The fire categories include prescribed burn and managed wildfire acreage proposed by alternative.

Table 14. Vegetation management activity objectives (table 1) for the life of the plan (15 years) by alternative for Ponderosa Pine Forest as a percentage (rounded to nearest integer) of its occurrence on the Cibola (acreages in parentheses).

Activity	Alternative A	Alternative B	Alternative C	Alternative D
Mechanical treatment	9% (39,375)	9% (39,375)	12% (55,125)	9% (39,375)
Prescribed fire	17% (75,938)	20% (91,125)	23% (106,313)	20% (91,125)
Managed wildfire	3% (14,814)	4% (16,295)	4% (17,776)	4% (16,295)
Total fire	20% (90,751)	24% (107,420)	27% (124,089)	24% (107,420)

Table 15. Vegetation management activity objectives (table 1) for the life of the plan (15 years) by alternative for Dry Mixed Conifer as a percentage (rounded to nearest integer) of its occurrence on the Cibola (acreages in parentheses).

Activity	Alternative A	Alternative B	Alternative C	Alternative D
Mechanical treatment	8% (13,125)	8% (13,125)	12% (18,375)	8% (13,125)
Prescribed fire	16% (25,313)	19% (30,375)	23% (35,438)	19% (30,375)
Managed wildfire	3% (5,113)	4% (5,624)	4% (6,136)	4% (5,624)
Total fire	19% (30,425)	23% (35,999)	26% (41,573)	23% (35,999)

[13] Riparian vegetation is addressed in the Water Resources section.

The effects of the management activity objectives on each vegetation type by alternative were modeled in VDDT. For the vegetation types modeled, all are projected to be in moderate or high departure for the near term (15 years) and long term (100, 1,000 years) except for Juniper Grass in the near term (table 16).

Table 16. Departure from desired conditions rating (%) and departure category (low, moderate, high, or unknown) for major Cibola vegetation types for all alternatives (unless otherwise noted)

Vegetation Type	Current	Projected +15 yrs	Projected +100 yrs	Projected +1,000 yrs
Juniper Grass (alternative A)	57 (moderate)	32 (low)	47 (moderate)	63 (moderate)
Juniper Grass (alternative B)	57 (moderate)	32 (low)	46 (moderate)	61 (moderate)
Juniper Grass (alternative C)	57 (moderate)	32 (low)	46 (moderate)	60 (moderate)
Juniper Grass (alternative D)	57 (moderate)	32 (low)	46 (moderate)	61 (moderate)
Dry Mixed Conifer (alternative A)	58 (moderate)	55 (moderate)	46 (moderate)	43 (moderate)
Dry Mixed Conifer (alternative B)	58 (moderate)	55 (moderate)	46 (moderate)	42 (moderate)
Dry Mixed Conifer (alternative C)	58 (moderate)	52 (moderate)	41 (moderate)	38 (moderate)
Dry Mixed Conifer (alternative D)	58 (moderate)	55 (moderate)	46 (moderate)	42 (moderate)
Wet Mixed Conifer (alternative A)	62 (moderate)	53 (moderate)	37 (moderate)	37 (moderate)
Wet Mixed Conifer (alternative B)	62 (moderate)	53 (moderate)	38 (moderate)	36 (moderate)
Wet Mixed Conifer (alternative C)	62 (moderate)	53 (moderate)	38 (moderate)	36 (moderate)
Wet Mixed Conifer (alternative D)	62 (moderate)	53 (moderate)	38 (moderate)	36 (moderate)
Madrean Pinyon-Oak Woodland (alternative A)	75 (high)	56 (moderate)	66 (moderate)	76 (high)
Madrean Pinyon-Oak Woodland (alternative B)	75 (high)	57 (moderate)	67 (high)	76 (high)
Madrean Pinyon-Oak Woodland (alternative C)	75 (high)	57 (moderate)	66 (moderate)	76 (high)
Madrean Pinyon-Oak Woodland (alternative D)	75 (high)	57 (moderate)	67 (high)	76 (high)
PJ Evergreen Shrub (alternative A)	75 (high)	66 (moderate)	50 (moderate)	51 (moderate)
PJ Evergreen Shrub (alternative B)	75 (high)	66 (moderate)	50 (moderate)	50 (moderate)
PJ Evergreen Shrub (alternative C)	75 (high)	66 (moderate)	50 (moderate)	50 (moderate)
PJ Evergreen Shrub (alternative D)	75 (high)	66 (moderate)	50 (moderate)	50 (moderate)
PJ Grass (alternative A)	50 (moderate)	44 (moderate)	51 (moderate)	51 (moderate)
PJ Grass (alternative B)	50 (moderate)	45 (moderate)	51 (moderate)	51 (moderate)
PJ Grass (alternative C)	50 (moderate)	44 (moderate)	50 (moderate)	50 (moderate)
PJ Grass (alternative D)	50 (moderate)	45 (moderate)	51 (moderate)	51 (moderate)
PJ Woodland (alternative A)	55 (moderate)	45 (moderate)	57 (moderate)	58 (moderate)
PJ Woodland (alternative B)	55 (moderate)	45 (moderate)	58 (moderate)	58 (moderate)
PJ Woodland (alternative C)	55 (moderate)	45 (moderate)	58 (moderate)	58 (moderate)
PJ Woodland (alternative D)	55 (moderate)	45 (moderate)	58 (moderate)	58 (moderate)
Ponderosa Pine Forest (alternative A)	77 (high)	70 (high)	58 (moderate)	57 (moderate)
Ponderosa Pine Forest (alternative B)	77 (high)	69 (high)	58 (moderate)	57 (moderate)
Ponderosa Pine Forest (alternative C)	77 (high)	69 (high)	58 (moderate)	57 (moderate)

Vegetation Type	Current	Projected +15 yrs	Projected +100 yrs	Projected +1,000 yrs
Ponderosa Pine Forest (alternative D)	77 (high)	69 (high)	58 (moderate)	57 (moderate)
Spruce-Fir Forest	50 (moderate)	Not assessed or unknown *	Not assessed or unknown *	Not assessed or unknown *
Colorado Plateau/Great Basin Grassland	41 (moderate)	Not assessed or unknown *	Not assessed or unknown *	Not assessed or unknown *
Gambel Oak Shrubland	47 (moderate)	Not assessed or unknown *	Not assessed or unknown *	Not assessed or unknown *
Mountain Mahogany/Mixed Shrubland	8 (low)	Not assessed or unknown *	Not assessed or unknown *	Not assessed or unknown *
Montane/Subalpine Grassland	28 (low)	Not assessed or unknown *	Not assessed or unknown *	Not assessed or unknown *
Semi-Desert Grassland	31 (low)	Not assessed or unknown *	Not assessed or unknown *	Not assessed or unknown *

* Insufficient sampling intensity of this vegetation type for modeling projected departure.

Assumptions

- Best management practices are followed, and long-term ecological condition and function improve as the result of vegetation management activities, although there may be some temporary impairment (soil disturbance, runoff, etc.) in the short-term.
- While objective acreages of managed wildfire vary slightly by alternative, the unpredictable nature of wildfire renders analysis of consequences based on wildfire highly speculative.
- On an acre-by-acre basis, the nature of the indirect effects of vegetation management activities on the ecological environment (soil condition, watershed, etc.) and socioeconomic environment (cash flow, employment, etc.) are not expected to differ by alternative, nor are they expected to differ based on where (wildland-urban interface, management area type, etc.) the activity occurs.
- Although the nature and degree of vegetation management activities and locations cannot be predicted in a programmatic environmental impact statement such as this, the relative number of projects and management activity acreages called for in the objectives of each alternative can be used for relative comparison of environmental consequences.

- While active vegetation management is less likely to occur in conservation management areas (alternative C) and recommended wilderness areas (alternatives B, C, D), these same areas would also be less likely to be treated under any alternative because they are generally remote and roadless. Objectives for place-based management areas (alternative B) do not specify any activity to occur; their desired conditions generally focus on maintaining their current characteristics. Under all alternatives, the wildland-urban interface is highly likely to be treated to protect resources both on, and adjacent to, the Cibola. Additionally, while restoration management areas may be a focus of activity under alternative C, some of these same areas are also likely to be treated under any alternative because of the Cibola's focus on improving the condition of highly departed fire-adapted forest vegetation types (Ponderosa Pine and Dry Mixed Conifer).[14] For these reasons, effects of vegetation management are expected to be concentrated in wildland-urban interface and restoration management areas. Conversely, effects of lack of vegetation management are expected to be concentrated in wilderness areas, conservation areas, and place-based management areas.
- Since VDDT modeling is not spatially explicit, alternative-specific projections of a vegetation type's structure cannot take into account the specific location(s) of where any management action will (wildland-urban interface, restoration management area) or will not (recommended wilderness, conservation area, place-based management area) occur; only the alternative-specific forestwide acreages of proposed activity are taken into account.
- Vegetation management-related objectives differ by alternative in annual acreage of managed wildfire and in mechanical treatment and prescribed fire in Ponderosa Pine and Dry Mixed Conifer forests (table 1). The rationale supporting differing, alternative-specific acreages of managed wildfire is related to fire suppression (or lack thereof) affecting other vegetation management activities (prescribed fire and mechanical treatment) in Ponderosa Pine and Dry Mixed Conifer forests and to the Cibola's emphasis on improving conditions in these two departed, fire-adapted vegetation types. Therefore, effects on vegetation, including from wildfire, are expected to be generally similar among all alternatives for all vegetation types except for Ponderosa Pine and Dry Mixed Conifer forests.
- Prescribed fire and mechanical vegetation treatments are specified to occur only in Ponderosa Pine and Dry Mixed Conifer forests (table 1), although small-scale, ancillary activity in other vegetation types is possible. Hence, overall current conditions and trends for ecological indicators in the remaining vegetation types are expected to continue.

Indicators

Vegetation-related characteristics, such as fire regime, patch size, species composition, ground cover, insects and disease, vulnerability to climate change, etc., are expected to respond (approach or depart from desired conditions) to management activities in the same manner and degree as vegetation structure. For example, as mechanical thinning and prescribed fire reduce patch size and fuel loading to historic levels, natural disturbances such as wildfire and insect and disease outbreaks are also expected to approach historical conditions (table 17). That is, where vegetation structure improves (lower departure) the most, vulnerability to climate change, fire risk, uncharacteristic damage from insects and disease, etc., are expected to correspondingly decrease the most, as well.

[14] Juniper Grass Woodland is the Cibola's only other fire-adapted woodland or forest. It is projected to improve from being in moderate departure (currently) to low-departure over the life of the plan under all alternatives without any proposed mechanical thinning or prescribed fire (Table 1).

Table 17. Effect of management activities (thinning, prescribed fire) on ecosystem indicators

Indicator	Effect
Understory structure	Reduced competition for sunlight, water, and soil nutrients increases understory growth, increasing ground cover and providing fine fuel to carry low-severity fire and promote the historic fire regime in fire-dependent ecosystems.
Species composition	Site conditions resemble historical conditions to which native species are adapted, thereby promoting desirable species composition.
Patch size	Patch size approaches historical conditions: (1) in forests and woodlands, openings are created, patch size is reduced, and (2) in shrublands and grasslands where encroaching trees have reduced patch size, thinning and prescribed burning remove trees and increase patch size.
Fire regime	Risk of catastrophic fire is reduced. In fire-adapted forests, reduction of ladder fuels promotes low-severity fire in stands now prone to uncharacteristic high-severity, stand-replacing crown fires. Reduced patch-size limits the areal extent of fires (less contiguous fuel source). Thinning and prescribed burning help restore characteristic stand structures which, in turn, sustain characteristic fire regimes.
Snags, coarse woody material, carbon	Less high-severity, stand-replacing fire maintains large, old trees that eventually die (snags), fall (coarse woody material), and decay, improving wildlife habitat, adding carbon to soil, thus improving soil structure and increasing soil water-holding capacity. Contrarily, high-severity fires tend to burn hotter and longer, which may increase water repellency of soil surface, thereby increasing water runoff, soil erosion, and stream sedimentation.
Climate	Reduction in stand density allows for (1) less sublimation of snow from foliage, (2) more precipitation reaching soil surface, and (3) less competition for soil water—combined with increased soil water-holding capacity—reduces water stress in plants and increases resistance to effects of climate change. Harvest also reduces risk of catastrophic wildfire, thereby reducing addition of carbon dioxide (via combustion) to the atmosphere and minimizing contribution to further climate change.
Forest insects and disease	Healthier trees are better able to withstand insect and disease attacks. Smaller patch-size reduces areal extent of infestations (less contiguous source of host plants).
Overall vegetation structure	Vegetation types approach their historic (characteristic) seral state proportions, decreasing overall departure: (1) In forests and woodlands, uncharacteristic high proportions of closed (overstocked) states are reduced and proportions of open states are increased, and (2) In shrublands and grasslands, proportions of uncharacteristic tree-encroached states are reduced, increasing proportions of non-encroached states.

Environmental Consequences Common to All Alternatives

The effects on ecological indicators described in this section are assumed to move the Cibola toward or away from desired conditions in the same manner, and to the same degree, under all alternatives.

The vegetation management components that differ among alternatives are the proposed objective acreages for mechanical treatment and prescribed fire in the Ponderosa Pine Forest and Dry Mixed Conifer vegetation types. For this reason, effects related to other vegetation types are expected to respond similarly among alternatives; however, these effects are expected to differ by system type (grassland, shrubland, etc.). As a result, effects common to all alternatives are addressed collectively for: all grassland, shrubland, and woodland vegetation types and the Spruce-Fir, and Wet Mixed Conifer forest vegetation types.

These consequences that are outlined by the aforementioned indicators will naturally shift in these vegetation types and under all alternatives without any influence from treatments identified within the land management plan objectives. That is, the effects common to all alternatives in these vegetation types result from lack of active management and are primarily driven by succession—progressive change in vegetation composition and structure over time (shifts in seral state proportions, increases in stocking density, fuel loading, etc.)—and incur associated changes in fire frequency and severity type, vulnerability to climate change and invasive species, etc.

Effects that differ by alternative primarily occur in the Cibola's two fire-adapted forest vegetation types (Ponderosa Pine and Dry Mixed Conifer) where proposed objectives for vegetation management activities vary by alternative. These effects to Ponderosa Pine and Dry Mixed Conifer will be addressed together by alternative following the consequences common to all alternatives below.

Grassland Vegetation Types

Understory Structure

Reduced patch size and altered fire regimes are expected to continue trending away from desired conditions and to threaten the Cibola's three grassland vegetation types. As woody species (trees and shrubs) continue to encroach, competition in the understory for sunlight, water, and soil nutrients increases, while productivity and ground cover are reduced. This in turn reduces the amount of fine fuel available to carry the historically characteristic frequent fires necessary to curb further tree encroachment and understory degradation.

Species Composition

Declining productivity in the understory reduces the frequency of native plant species while simultaneously opening niches for more competitive nonnative, invasive species, and moving away from desired conditions. With the reduced fire frequency Cibola's grassland vegetation types are currently experiencing, these invasive species would be allowed to proliferate and spread. Wildfire may temporarily remove invasive species, but the recovering plant community response would be influenced by the amount and proportions of surviving plants and viable propagules in the soil seed bank.

Patch Size

Without stand-replacing wildfire or vegetation management activities designed to remove woody species from grasslands, patch size is expected to continue to decrease (further from desired conditions). Wildfire in the grassland vegetation types that removes encroaching woody vegetation would be expected to increase their patch size. Note: Some ancillary removal of woody species in grasslands may occur in association with thinning and prescribed burning in adjacent Ponderosa Pine and Dry Mixed Conifer forests.

Fire Regime

Fire frequency is expected to continue to decrease (further from desired conditions) as tree and shrub encroachment reduces fine fuels, promoting further encroachment and understory decline.

Snags, Coarse Woody Material, Carbon

Snags and coarse woody material are not characteristic of grassland vegetation types; however, the natural, annual turnover of herbaceous material provides litter which contributes to the formation of soil organic matter (carbon). This organic matter improves surface texture (aiding in water infiltration, reducing runoff and erosion) and increases the water holding capacity of the soil. As tree and shrub encroachment reduces understory production, the amount of litter, soil carbon, and soil water holding capacity are expected to decrease.

Climate

The Montane/Subalpine and Colorado Plateau/Great Basin Grasslands are currently highly vulnerable to losing key ecosystem characteristics in response to climate change, and the Semi-Desert Grassland is at moderate risk (Triepke et al. 2014). Montane/Subalpine Grasslands may be considered especially sensitive to climate change, as they occur at the highest elevations and are therefore incapable of uphill migration as a climate change response. Although hard to predict, the Cibola's grassland vegetation types are expected to remain at current risk levels over the life of the plan. Risks include decrease in overall acreage and distribution and shifts in plant species frequency and composition.

Overall Vegetation Structure

All three of the Cibola's grassland vegetation types are lacking in the high-seral state (less than historic) (USDA Forest Service 2015a) and are expected to maintain this condition for the life of the plan. In turn, species composition and soil condition may trend further away from desired conditions, and wildlife that is associated with the high seral state may experience habitat loss.

Shrubland Vegetation Types

Understory Structure, Species Composition, and Invasive Species

Nonnative, invasive herbaceous species are expected to continue to threaten Intermountain Salt Scrub, Chihuahuan Salt Desert Scrub, Chihuahuan Desert Scrub, and Sandsage. While the primary threat to Sagebrush Shrubland over most of its range (Great Basin) is the exotic annual grass, cheatgrass, its primary threat on the Cibola is juniper encroachment; this threat is expected to continue over the life of the plan except where incidental juniper removal occurs in association with thinning and prescribed burning in adjacent Ponderosa Pine and Dry Mixed Conifer forests. Wildfire may temporarily remove invasive species, but the recovering plant community response would be influenced by the amount and proportions of surviving plants and viable propagules in the soil seed bank. Gambel Oak Shrubland and Mountain Mahogany/Mixed Shrubland are not currently threatened and are expected to maintain desirable species composition for the life of the plan.

Patch Size and Fire Regime

For the three shrubland vegetation types with known fire history on the Cibola—Gambel Oak Shrubland, Mountain Mahogany/Mixed Shrubland, and Sagebrush Shrubland—fire return intern interval is longer than their historic fire regime (USDA Forest Service 2015a) and is expected to remain so. For Gambel Oak and Mountain Mahogany/Mixed Shrublands, the historic average fire return interval was 35 to 200 years from stand-replacing fire; however, most recent fires have been nonlethal allowing their patch sizes to increase. In the absence of stand-replacing wildfire, it is expected trends in fire regime and patch size would continue for the life of the plan.

Sagebrush Shrubland has historically experienced a similar fire return interval of 35 to 200 years, but its fire history on the Cibola is unknown. It is the only one of the Cibola's seven shrubland vegetation types threatened by juniper encroachment (Wahlberg et al. 2015), which may be a contributing factor to its decreased patch size. This trend is expected to continue over the life of the plan except where incidental juniper removal occurs in association with thinning and prescribed burning in adjacent Ponderosa Pine and Dry Mixed Conifer forests.

In the Intermountain Salt Scrub, Chihuahuan Salt Desert Scrub, Chihuahuan Desert Scrub, and Sandsage Shrublands, the primary threat is exotic, herbaceous species which often promote their own persistence by shortening the historically long fire-return interval that is characteristic of these vegetation types. Although their fire history on the Cibola is unknown, it can be speculated they are currently experiencing shortened fire return intervals which may, in turn, explain their decreased patch size. It is expected these trends would continue over the life of the plan.

Snags, Coarse Woody Material, Carbon

Snags are not characteristic of shrubland vegetation types, although small diameter coarse woody material is produced by the shrub component. Additionally, the natural, annual turnover of herbaceous material provides litter which contributes to the formation of soil organic matter (carbon). This organic matter improves surface texture (aiding in water infiltration, reducing runoff and erosion) and increases the water-holding capacity of the soil. Tree encroachment in the Sagebrush Shrubland vegetation type, as well as patch-size increases in Gambel Oak and Mountain Mahogany/Mixed Shrublands may increase the amount of snags, coarse woody material, and carbon. The decreased patch size in Intermountain Salt Scrub, Chihuahuan Salt Desert Scrub, Chihuahuan Desert Scrub, and Sandsage Shrublands may lessen their overall carbon contribution, but given their limited area—they collectively occupy less than 1 percent of the Cibola—any such effect would likely be minimal over the life of the plan.

Climate

Six of the Cibola's seven shrubland vegetation types are highly vulnerable to losing key ecosystem characteristics in response to climate change; Mountain Mahogany Mixed Shrubland is at moderate risk (Triepke et al. 2014). Although hard to predict, these are expected to remain at current risk levels over the life of the plan. Risks include changes to species composition and distribution.

Overall Vegetation Structure

Effects on overall vegetation structure in the Cibola's shrubland vegetation types would likely result from wildfire (all shrubland types) or from ancillary thinning and prescribed burning in Sagebrush Shrubland communities that are adjacent Ponderosa Pine and Dry Mixed Conifer forests.

How overall vegetation structure is affected by wildfire or vegetation management activities is reflected in changes in the proportions of seral states for each vegetation type (overall departure). Adequate data were available to determine departure of overall vegetation structure for the Gambel Oak and Mountain Mahogany/Mixed Shrublands (table 16). In the Gambel Oak Shrublands (currently with an overrepresentation of treed states), wildfire, prescribed fire, or thinning would likely cause a beneficial reduction in treed states, but the corresponding increase in the early seral state (currently in reference condition proportion) would be detrimental. Alternatively, Mountain Mahogany/Mixed Shrubland, which is currently near reference conditions (low departure), would not benefit from any significant change in seral state proportions.

Adequate data were not available to determine departure of overall vegetation structure for Sagebrush Shrubland, Intermountain Salt Scrub, Chihuahuan Salt Desert Scrub, Chihuahuan Desert Scrub, and Sandsage. Their overall vegetation departure was estimated using litter cover and plant basal cover (USDA Forest Service 2015a). Chihuahuan Desert Scrub and Sandsage are in low departure from reference conditions and would likely be negatively affected by any management action or wildfire. However, Sagebrush Shrubland, Intermountain Salt Scrub, and Chihuahuan Salt Desert Scrub are highly departed and may or may not benefit from management action or wildfire, depending on the site-specific cause for departure. Generally however, the likely scenario where current structure is underrepresented in high- or mid-seral states, wildfire would further increase the overrepresentation of early seral states, thus further increasing departure. Conversely, wildfire would benefit communities where early seral states are underrepresented.

Woodland Vegetation Types

Understory Structure

Currently, the understory structure of all five Cibola woodlands is in low departure (USDA Forest Service 2015a), and in the absence of wildfire or vegetation management activity, it would generally be expected to remain so for the life of the plan except after uncharacteristic, stand-replacing, high-severity wildfire—with the exception PJ Woodland, the only woodland vegetation type on the Cibola for which stand-replacing, high-severity wildfire is characteristic. Stand-replacing, high-severity wildfire is a distinct possibility in Madrean Pinyon-Oak, PJ Evergreen Shrub, and PJ Grass Woodlands which are overstocked; Juniper Grass Woodland currently has an overabundance of early seral, open stands and is not prone to high-severity fire.

Species Composition

The status of species composition in Cibola's woodlands is unknown, but it can be speculated that with the good ecological condition of the understory in all five of the Cibola's woodlands, species composition is likely similar to reference conditions and likely to remain so for the life of the plan. Exceptions may exist in disturbed areas (post wildfire, recreation sites, roadsides, etc.), which are prone to invasion by nonnative, invasive species, where once introduced, tend to proliferate and spread.

Patch Size

All five Cibola woodland vegetation types are highly departed from reference conditions with overly large average patch sizes (USDA Forest Service 2015a). This could be due in part to historic fire suppression and removal of fine fuels. Another reason may be that as woodland tree species, primarily juniper, encroach into adjacent shrublands and grasslands (reducing their patch size), woodland patch size increases. This trend is likely to continue over the life of the plan.

Fire Regime

The fire return intervals for all five Cibola woodland vegetation types have dramatically increased from reference conditions (Wahlberg et al. 2015). This trend is expected to continue over the life of the plan.

Snags, Coarse Woody Material, Carbon

Snags and coarse woody material for all five Cibola woodlands is generally within historic levels (USDA Forest Service 2015a). Under the uncharacteristically long fire return intervals, this material is expected to accumulate to uncharacteristic levels, albeit slowly, although this might be counterbalanced forestwide within a vegetation type where uncharacteristic stand-replacing, high-severity wildfire occurs, although the effect locally would be a drastic reduction (below historic levels). Carbon stocks on the Cibola are largely stable or improving (USDA Forest Service 2015a) given the favorable status of snags and coarse woody material, this trend is expected to continue over the life of the plan.

Climate

All five Cibola woodland vegetation types are at least moderately vulnerable to climate change (PJ Grass is highly vulnerable) (Triepke et al. 2014) and these conditions are expected to continue over the life of the plan.

Forest Insects and Disease

Madrean Pinyon-Oak Woodland, PJ Evergreen Shrub, PJ Grass, and PJ Woodland vegetation types are all at high risk from forest insects and disease; Juniper Grass is the only Cibola woodland vegetation type not currently at risk. Occurrences of insect and disease outbreaks are exacerbated by larger patch sizes, longer fire return intervals, and a warmer climate; therefore, insect and disease outbreaks can be expected to be increasingly more prevalent over the life of the plan in all woodland types except where wildfire removes existing infested trees or decreases patch size.

Overall Vegetation Structure

Juniper Grass, PJ Grass, and PJ Woodland vegetation types are moderately departed in overall seral state proportions, and Madrean Pinyon-Oak Woodland and PJ Evergreen Shrub are highly departed (table 16). All are projected to improve somewhat (especially Juniper Grass) over the life of the plan, but with only PJ Evergreen Shrub improving long term (table 16). All of these vegetation types are underrepresented by open stands of large trees and overrepresented by the early seral state (grass, forb, shrub), and all but Juniper Grass have an overabundance of closed stands of small trees (appendix B). These closed stands are highly vulnerable to stand-replacing fire which would further increase proportion of the already overabundant early seral state, and delay the already long process of gaining open stands of large trees. These conditions are not expected to improve over the life of the plan and would likely worsen in the event of wildfire.

Spruce-Fir and Wet Mixed Conifer Forest Vegetation Types

Understory Structure

Currently, the understory structure of Spruce-Fir and Wet Mixed Conifer forests is in low departure (USDA Forest Service 2015a), and in the absence of wildfire or vegetation management activity, it would generally be expected to remain in its current condition for the life of the plan—unless the recent trend of increasing, uncharacteristic, low-severity fires causes declines in the older, larger portions of the understory that may be killed in low-severity fires.

Species Composition

The status of species composition in Cibola's Spruce-Fir and Wet Mixed Conifer forests is unknown, but it can be speculated that with the good ecological condition of the understory in these two vegetation types, species composition is likely similar to reference conditions and likely to remain so for the life of the plan (15 years). Exceptions may exist in disturbed areas (post wildfire, recreation sites, roadsides, etc.), which are prone to invasion by nonnative, invasive species, where once introduced, tend to proliferate and spread.

Patch Size

Cibola's Spruce-Fir and Wet Mixed Conifer forests are highly departed from reference conditions with overly large average patch sizes (USDA Forest Service 2015a). This is most likely due to historic fire suppression and removal of fine fuels. With recent firefighting strategies emphasizing less-than-full suppression where other resources may benefit, patch size may trend downward over time. However, the overall trend is hard to predict, as climate change threatens to increase the frequency and severity of fires, and, with limited agency resources, patch size may well continue to increase.

Fire Regime

The fire regime of Wet Mixed Conifer is moderately departed; while the fire return interval is similar to reference conditions, most recent fires have been nonlethal (versus mostly mixed severity or stand-replacing under reference conditions) (USDA Forest Service 2015a). The fire regime of Spruce-Fir is highly departed, reflecting the shift from historic, mostly stand-replacing fire to mostly non-lethal fire today (USDA Forest Service 2015a). It is likely these trends are responsible for the overabundance of low-seral stands and near absence of mature stands with large trees. These fire regime trends and their effects may continue over the life of the plan, especially in Spruce-Fir, as its dominant tree species, Engelmann spruce and subalpine fir, have low and very-low fire resistance, respectively (Starker 1934).

Snags, Coarse Woody Material, Carbon

Snags and coarse woody material in the Wet Mixed Conifer and Spruce-Fir forests are in generally good condition, except for a paucity of large snags in Spruce-Fir (USDA Forest Service 2015a). Carbon stocks in these two forest types are largely stable or improving (USDA Forest Service 2015a).With an expected, continued increase in low-severity fires and continued underrepresentation of stands with large, old trees that provide crucial wildlife habitat, it can be speculated there may be a slow steady decrease in the amount of snags (also important to wildlife) and coarse woody material and decreased carbon inputs to the soil.

Climate

Currently, both Wet Mixed Conifer and Spruce-Fir vegetation types are highly vulnerable to climate change (Triepke et al. 2014). Since Spruce-Fir occurs at the highest elevations, it may be especially vulnerable, as it occurs at the highest elevations and is therefore incapable of uphill migration as a climate change response. These conditions are expected to continue over the life of the plan.

Forest Insects and Disease

Both Wet Mixed Conifer and Spruce-Fir vegetation types are currently at high risk from forest insects and disease (USDA Forest Service 2015a). The shift from historic, mostly stand-replacing fire to mostly non-lethal fire today (USDA Forest Service 2015a) may be contributing to the current levels of insect and disease infestations, as the plant mortality from low-severity fire is concentrated in the understory. Combined with larger patch sizes and a warmer climate, insect and disease outbreaks can be expected to be increasingly more prevalent over the life of the plan except where wildfire removes existing infested trees or decreases patch size.

Overall Vegetation Structure

Overall stand structure of Wet Mixed Conifer and Spruce-Fir vegetation types is currently moderately departed (table 16), primarily due to the loss of states dominated by large trees (USDA Forest Service 2015a). However, the currently overrepresented states with medium trees in Wet Mixed Conifer are projected to decrease over the next 100 years (and remain stable thereafter) while the currently underrepresented states with large trees are projected to steadily increase over the next 1,000 years (appendix B). There is not enough acreage of Spruce-Fir on the Cibola to model (table 16), but hopefully the same trend would apply there, as these two vegetation types share other ecological characteristics (stand structure, fire regime), both historically and currently. These trends may manifest themselves in improved condition in other structure- and fire regime-related characteristics like reduced patch size and historic insect and disease cycles and patterns; however, the vegetation modeling assumes current climate conditions persist, so climate change may counter such favorable projections.

Environmental Consequences: Ponderosa Pine Forest and Dry Mixed Conifer Vegetation Types

Alternative A, No Action Alternative

Understory Structure

Mechanical treatments may improve understory structure by reducing overstory density of overstocked stands, thus reducing competition in the understory for sunlight, water, and nutrients and increasing productivity. Prescribed fire and wildfire may provide similar benefits, but the patterns of activity tend to be less uniformly distributed and in larger patches (especially for wildfire). Currently, the understory structure of Ponderosa Pine Forest and Dry Mixed Conifer vegetation types is in good condition (USDA Forest Service 2015a) and is expected to remain so over the life of the plan. Just under 10 percent of these vegetation types is scheduled to receive mechanical treatment over the life of the plan (table 14 and table 15), and this may further ensure that they would remain stable or improve (closer to desired conditions) roughly to the same degree as under alternatives B and D, but less so than alternative C which is scheduled to treat 12 percent.

Prescribed fire and wildfire follow a similar pattern among the alternatives, with alternative A receiving the least amount of fire (table 14 and table 15), followed by alternatives B, and D, with alternative C receiving the most. Of the four alternatives, understory structure would likely improve the least overall under alternative A based on these projected levels of mechanical treatment and fire.

Species Composition

The status of species composition in Cibola's Ponderosa Pine Forest and Dry Mixed Conifer vegetation types is unknown, but it can be speculated that with the good ecological condition of the understory in these two vegetation types, species composition is likely similar to reference conditions and likely to remain so for the life of the plan, following a similar response among alternatives as understory structure. However, disturbances such as mechanical treatment, prescribed fire, and wildfire inevitably increase the risk of introduction of nonnative species, even when best management practices are followed. Thus, while the least amount of management activity-related benefit to species composition may occur under alternative A, management-related vulnerability to the introduction of undesirable species may be the least under alternative A as well.

Patch Size

Ponderosa Pine Forest and Dry Mixed Conifer vegetation types are highly departed from reference conditions with overly large average patch sizes (USDA Forest Service 2015a). This is most likely due to historic fire suppression and removal of fine fuels. Mechanical treatments, prescribed fire, and managed wildfire may potentially move the Cibola closer to desired conditions for patch size, but any such movement would likely be the least under alternative A (fewest total acres of activity, table 14 and table 15) compared to the other alternatives. However, the overall trend is hard to predict, as climate change threatens to increase the frequency and severity of fires, and, with limited agency resources, patch size may well continue to increase.

Fire Regime

Mechanical treatments, prescribed fire, and managed wildfire in Ponderosa Pine Forest and Dry Mixed Conifer vegetation types strive to create stand structure and landscape patterns that approach historical conditions, thereby setting the stage for a return to a more characteristic fire regime of frequent, non-lethal surface fires in these fire-adapted systems. Such a management-induced shift toward desired conditions for fire regime is expected to occur under all alternatives but least of all under alternative A because it contains the smallest amount of mechanical treatment, prescribed fire, and wildfire among the alternatives (table 14 and table 15).

Snags, Coarse Woody Material, Carbon

Snags and coarse woody material in Ponderosa Pine Forest and Dry Mixed Conifer vegetation types are within historical conditions, and carbon stocks in these two forest types are largely stable or improving (USDA Forest Service 2015a). While belowground carbon is slow to respond to management activity, aboveground biomass (snags, coarse woody material, live trees) responds quickly to timber harvest, prescribed fire, and wildfire. Management-induced reductions in aboveground biomass such as these may result in less long-term loss of aboveground carbon where those management actions produce more characteristic fuel loading and landscape patterns, thus reducing risk of catastrophic fire and greater overall carbon loss. While carbon levels are not expected to change significantly over the life of the plan under any alternative, management-induced indirect benefits would be lowest under alternative A, based on the relative acreages of projected management activities (table 14 and table 15).

Climate

Currently, both Ponderosa Pine and Dry Mixed Conifer vegetation types are highly vulnerable to climate change (Triepke et al. 2014). Mechanical treatment, prescribed fire, and managed wildfire may reduce vulnerability to climate change by lowering density in overstocked stands thereby reducing competition for soil water. Based on combined treatment levels of mechanical treatment, prescribed fire, and managed wildfire (table 14 and table 15), alternative A would move the Cibola toward desired conditions the least of the four alternatives.

Forest Insects and Disease

Both Ponderosa Pine and Dry Mixed Conifer vegetation types are currently at risk from forest insects and disease (USDA Forest Service 2015a). The recent shift away from historic, frequent, low-severity fires toward stand-replacing fires, combined with overstocked, larger patch sizes, likely contributes to current infestation levels and future risks. Mechanical treatment, prescribed fire, and managed wildfire may reduce infestation risk by lowering density in overstocked stands and reducing patch size, thereby creating smaller, more open stands that are less conducive to insect and disease outbreaks. Based on combined treatment levels of mechanical treatment, prescribed fire, and managed wildfire (table 14 and table 15), alternative A would move the Cibola toward desired conditions the least of the four alternatives.

Overall Vegetation Structure

Ponderosa Pine is highly departed and Dry Mixed Conifer is moderately departed (table 16), in both cases largely because of an overrepresentation of states composed of closed stands of small trees and an underrepresentation of states composed of open stands of larger trees (appendix B). Overall departure is projected to steadily decrease in both of these vegetation types over the next 15, 100, and 1,000 years, mostly because of two beneficial shifts: a reduction in closed stands of small trees and an increase in open stands of larger trees (appendix B). This movement toward desired conditions for Dry Mixed Conifer is modest, with the least improvement under alternative A, while there is almost no difference among alternatives for Ponderosa Pine Forest (table 16).

Alternatives B and D

Alternatives B and D have similar objectives for vegetation management activities (table 14 and table 15) and similar environmental consequences, so they are addressed together in this section.

Understory Structure

Mechanical treatments may improve understory structure by reducing overstory density of overstocked stands, thus reducing competition in the understory for sunlight, water, and nutrients and increasing productivity. Prescribed fire and wildfire may provide similar benefits, but the patterns of activity tend to be less uniformly distributed and in larger patches (especially for wildfire). Currently, the understory structure of Ponderosa Pine Forest and Dry Mixed Conifer vegetation types is in good condition (USDA Forest Service 2015a) and is expected to remain so over the life of the plan. Just under 10 percent of these vegetation types is scheduled to receive mechanical treatment over the life of the plan (table 14 and table 15), and this may further ensure they would remain stable or improve (closer to desired conditions) roughly to the same degree as under alternative A but less so than C which is scheduled to treat 12 percent.

Prescribed fire and wildfire follow a similar pattern among the alternatives, with alternative A receiving the least amount of fire (table 14 and table 15), followed by alternatives B, and D, with C receiving the most. Under alternatives B and D, understory structure move toward desired conditions more than under alternative A but less than under alternative C based on these projected levels of mechanical treatment and fire.

Species Composition

The status of species composition in Cibola's Ponderosa Pine Forest and Dry Mixed Conifer vegetation types is unknown, but it can be speculated that with the good ecological condition of the understory in these two vegetation types, species composition is likely similar to reference conditions and likely to remain so for the life of the plan, following a similar response among alternatives as understory structure. However, disturbances such as mechanical treatment, prescribed fire, and wildfire inevitably increase the risk of introduction of nonnative species, even when best management practices are followed. Thus, management-activity-related benefit to species composition under alternatives B and D is expected to be more than under alternative A and less than under alternative C, while management-related vulnerability to the introduction of undesirable species under alternatives B and D is expected to be more than under alternative A and less than under alternative C.

Patch Size

Ponderosa Pine Forest and Dry Mixed Conifer vegetation types are highly departed from reference conditions with overly large average patch sizes (USDA Forest Service 2015a). This is most likely due to historic fire suppression and removal of fine fuels. Mechanical treatments, prescribed fire, and managed wildfire may potentially move the Cibola closer to desired conditions for patch size, and any such movement under alternatives B and D would likely be the more than under alternative A and less than alternative C (most total acres of activity, table 14 and table 15). However, the overall trend is hard to predict, as climate change threatens to increase the frequency and severity of fires, and, with limited agency resources, patch size may well continue to increase.

Fire Regime

Mechanical treatments, prescribed fire, and managed wildfire in Ponderosa Pine Forest and Dry Mixed Conifer vegetation types strive to create stand structure and landscape patterns that approach historical conditions, thereby setting the stage for a return to a more characteristic fire regime of frequent, non-lethal surface fires in these fire-adapted systems. Such a management-induced shift toward desired conditions for fire regime is expected to occur under all alternatives, more so under alternatives B and D than under alternative A but less so than under alternative C which contains the highest amount of mechanical treatment, prescribed fire, and wildfire among the alternatives (table 14 and table 15).

Snags, Coarse Woody Material, Carbon

Snags and coarse woody material in Ponderosa Pine Forest and Dry Mixed Conifer vegetation types are within historical conditions, and carbon stocks in these two forest types are largely stable or improving (USDA Forest Service 2015a). While belowground carbon is slow to respond to management activity, aboveground biomass (snags, coarse woody material, live trees) responds quickly to timber harvest, prescribed fire, and wildfire.

Management-induced reductions in aboveground biomass such as these may result in less long-term loss of aboveground carbon where those management actions produce more characteristic fuel loading and landscape patterns, thus reducing risk of catastrophic fire and greater overall carbon loss. While carbon levels are not expected to change significantly over the life of the plan under any alternative, management-induced indirect benefits under alternatives B and D would be higher than under alternative A and lower than under alternative C, based on the relative acreages of projected management activities (table 14 and table 15).

Climate

Currently, both Ponderosa Pine and Dry Mixed Conifer vegetation types are highly vulnerable to climate change (Triepke et al. 2014). Mechanical treatment, prescribed fire, and managed wildfire may reduce vulnerability to climate change by lowering density in overstocked stands thereby reducing competition for soil water. Based on combined treatment levels of mechanical treatment, prescribed fire, and managed wildfire (table 14 and table 15), the Cibola would move toward desired conditions under alternatives B and D more quickly than under alternative A but less quickly than under alternative C.

Forest Insects and Disease

Both Ponderosa Pine and Dry Mixed Conifer vegetation types are currently at risk from forest insects and disease (USDA Forest Service 2015a). The recent shift away from historic, frequent, low-severity fires toward stand-replacing fires, combined with overstocked, larger patch sizes, likely contributes to current infestation levels and future risks. Mechanical treatment, prescribed fire, and managed wildfire may reduce infestation risk by lowering density in overstocked stands and reducing patch size, thereby creating smaller, more open stands that are less conducive to insect and disease outbreaks. Based on combined treatment levels of mechanical treatment, prescribed fire, and managed wildfire (table 14 and table 15), the Cibola would move toward desired conditions under alternatives B and D more quickly than under alternative A but less quickly than under alternative C.

Overall Vegetation Structure

Ponderosa Pine is highly departed and Dry Mixed Conifer is moderately departed (table 16), in both cases largely because of an overrepresentation of states composed of closed stands of small trees and an underrepresentation of states composed of open stands of larger trees (appendix B). Overall departure is projected to steadily decrease in both of these vegetation types over the next 15, 100, and 1,000 years, mostly because of two beneficial shifts: a reduction in closed stands of small trees and an increase in open stands of larger trees (appendix B). This movement toward desired conditions for Dry Mixed Conifer is modest, with more improvement under alternatives B and D than under alternative A but less than under alternative C, while there is almost no difference among alternatives for Ponderosa Pine Forest (table 16).

Alternative C

Understory Structure

Mechanical treatments may improve understory structure by reducing overstory density of overstocked stands, thus reducing competition in the understory for sunlight, water, and nutrients and increasing productivity. Prescribed fire and wildfire may provide similar benefits, but the patterns of activity tend to be less uniformly distributed and in larger patches (especially for wildfire). Currently, the understory structure of Ponderosa Pine Forest and Dry Mixed Conifer vegetation types is in good condition (USDA Forest Service 2015a) and is expected to remain so over the life of the plan.

Under alternative C, 12 percent of these vegetation types is scheduled to receive mechanical treatment over the life of the plan —the most of any alternative (table 14 and table 15)—and this may further ensure they would remain stable or improve (closer to desired conditions) more than under the other alternatives.

Prescribed fire and wildfire follow a similar pattern among the alternatives, with alternative C receiving the highest amount of fire (table 14 and table 15), followed by alternatives B, and D, with alternative A receiving the least. Of the four alternatives, understory structure would likely improve the most overall under alternative C based on these projected levels of mechanical treatment and fire.

Species Composition

The status of species composition in Cibola's Ponderosa Pine Forest and Dry Mixed Conifer vegetation types is unknown, but it can be speculated that with the good ecological condition of the understory in these two vegetation types, species composition is likely similar to reference conditions and likely to remain so for the life of the plan, following a similar response among alternatives as understory structure. However, disturbances such as mechanical treatment, prescribed fire, and wildfire inevitably increase the risk of introduction of nonnative species, even when best management practices are followed. Thus, while the highest amount of management-activity-related benefit to species composition may occur under alternative C, management-related vulnerability to the introduction of undesirable species may be highest under alternative C as well.

Patch Size

Ponderosa Pine Forest and Dry Mixed Conifer vegetation types are highly departed from reference conditions with overly large average patch sizes (USDA Forest Service 2015a). This is most likely due to historic fire suppression and removal of fine fuels. Mechanical treatments, prescribed fire, and managed wildfire may potentially move the Cibola closer to desired conditions for patch size, and any such movement would likely be highest under alternative C (highest total acres of activity, table 14 and table 15) compared to the other alternatives. However, the overall trend is hard to predict, as climate change threatens to increase the frequency and severity of fires, and, with limited agency resources, patch size may well continue to increase.

Fire Regime

Mechanical treatments, prescribed fire, and managed wildfire in Ponderosa Pine Forest and Dry Mixed Conifer vegetation types strive to create stand structure and landscape patterns that approach historical conditions, thereby setting the stage for a return to a more characteristic fire regime of frequent, non-lethal surface fires in these fire-adapted systems. Such a management-induced shift toward desired conditions for fire regime is expected to occur under all alternatives but most of all under alternative C because it contains the highest amount of mechanical treatment, prescribed fire, and wildfire among the alternatives (table 14 and table 15).

Snags, Coarse Woody Material, Carbon

Snags and coarse woody material in Ponderosa Pine Forest and Dry Mixed Conifer vegetation types are within historical conditions, and carbon stocks in these two forest types are largely stable or improving (USDA Forest Service 2015a). While belowground carbon is slow to respond to management activity, aboveground biomass (snags, coarse woody material, live trees) responds quickly to timber harvest, prescribed fire, and wildfire.

Management-induced reductions in aboveground biomass such as these may result in less long-term loss of aboveground carbon where those management actions produce more characteristic fuel loading and landscape patterns, thus reducing risk of catastrophic fire and greater overall carbon loss. While carbon levels are not expected to change significantly over the life of the plan under any alternative, management-induced indirect benefits would be highest under alternative C, based on the relative acreages of projected management activities (table 14 and table 15).

Climate

Currently, both Ponderosa Pine and Dry Mixed Conifer vegetation types are highly vulnerable to climate change (Triepke et al. 2014). Mechanical treatment, prescribed fire, and managed wildfire may reduce vulnerability to climate change by lowering density in overstocked stands thereby reducing competition for soil water. Based on combined treatment levels of mechanical treatment, prescribed fire, and managed wildfire (table 14 and table 15), alternative C would move the Cibola toward desired conditions the most of any alternative.

Forest Insects and Disease

Both Ponderosa Pine and Dry Mixed Conifer vegetation types are currently at risk from forest insects and disease (USDA Forest Service 2015a). The recent shift away from historic, frequent, low-severity fires toward stand-replacing fires, combined with overstocked, larger patch sizes, likely contributes to current infestation levels and future risks. Mechanical treatment, prescribed fire, and managed wildfire may reduce infestation risk by lowering density in overstocked stands and reducing patch size, thereby creating smaller, more open stands that are less conducive to insect and disease outbreaks. Based on combined treatment levels of mechanical treatment, prescribed fire, and managed wildfire (table 14 and table 15), alternative C would move the Cibola toward desired conditions the most of any alternative.

Overall Vegetation Structure

Ponderosa Pine is highly departed and Dry Mixed Conifer is moderately departed (table 16), in both cases largely because of an overrepresentation of states composed of closed stands of small trees and an underrepresentation of states composed of open stands of larger trees (appendix B). Overall departure is projected to steadily decrease in both of these vegetation types over the next 15, 100, and 1,000 years, mostly because of two beneficial shifts: a reduction in closed stands of small trees and an increase in open stands of larger trees (appendix B). This movement toward desired conditions for Dry Mixed Conifer is modest, with the most improvement under alternative C, while there is almost no difference among alternatives for Ponderosa Pine Forest (table 16).

Cumulative Environmental Consequences

Off-Cibola overall departure of vegetation structure was analyzed at the context scale[15] in the Cibola assessment (USDA Forest Service 2015a) and was generally found to be in similar or better (lower departure) condition compared to the Cibola. The context scale is not appropriate for effects analysis here. It extends hundreds of miles from the Cibola in some instances, and it does not include some portions of the Cibola in other instances.

[15] The "context" scale" is the cluster of all ecological subsections (McNab et al. 2005) that intersect at least 1 percent of the Cibola.

In this section, the area of analysis for cumulative environmental consequences includes all areas within ten miles of any part of the Cibola. Ongoing and planned projects (over the life of the Cibola plan) were identified in the New Mexico vegetation treatment geodatabase, created by the New Mexico Forest and Watershed Restoration Institute (NMFWRI) for the Forest and Watershed Health Coordinating Group (https://nmfwri.org/gis-projects/nm-vegetation-treatment-mapping). This geodatabase allows the user to visually identify specific projects interactively in an online GIS interface and to download text files with detailed information for each project.

Forty-three cooperating agencies have signed a memorandum of understanding as units of government representing diverse interests and communities such as soil and water conservation districts, city and county governments, tribes, land grants, and State and Federal agencies. Their respective vegetation management plans, as well as community wildfire protection plans, are on file in the Cibola National Forest Supervisor's Office. These plans share a common philosophy with the Cibola of sound multiple-use land management that provides ecosystem services while promoting ecosystem health and public safety. As such, extra-agency vegetation management projects that occur, or are planned to occur, off the national forest (table 18) often mimic those of the Cibola in methods and goals. These projects total over 15,000 acres and largely consist of mechanical thinning or prescribed burning to reduce density and fuel loading in overstocked stands to improve ecosystem function and reduce the risk of uncharacteristic, catastrophic fire while reducing vulnerability to climate change.

In 2016, the Cibola personnel and cooperating agencies participated in the formation of a collaborative for each of the four mountain districts and a forestwide collaborative—the Cibola Shared Stewardship Collaborative. Cibola personnel joined with partners to kick off these formal collaboration teams consisting of members of the public and nonprofit and government entities. The purpose of the Cibola Shared Stewardship Collaborative is to provide input to the Cibola leadership team on the use and management of the Cibola's multiple resources. This ongoing communication among the Cibola and its partners, along with real-time, up-to-the-date project information sharing via the New Mexico Forest and Watershed Restoration Institute, ensures that the philosophy of an "all lands" approach manifests itself in on-the-ground, synergistic benefit among the Cibola and its partners and adjacent landowners. Cibola vegetation management projects are expected to be complemented and enhanced from nearby projects on adjacent lands. Assuming best management practices are followed on adjacent lands, cumulative environmental consequences for all ecosystem indicators of vegetation condition under all alternatives are expected to be beneficial for all ongoing and planned projects. Rationale for these project benefits are provided in table 17, with most benefits occurring on-site (within the project areas) but with collateral, indirect benefits occurring off-site (on adjoining lands), including the Cibola:

- Direct benefits from mechanical (thinning, mastication, etc.) and prescribed fire projects: restoration of historic patch size and stand structure, reduced fuel loading, improved overall vegetation structure, increased soil water availability.
- Indirect benefits from thinning and burning projects: reduced risk from invasive species, reduced vulnerability to insects and disease, reduced risk of uncharacteristic fire, increased resistance and resilience to climate change.
- Direct benefits from herbicidal treatment of creosote bush (Seferino Hill project, table 18) may promote grass production, thereby increasing surface litter and improving soil texture and water infiltration on-site, possible reducing runoff and erosion both on- and off-site.

Table 18. List of ongoing and planned vegetation management projects slated to occur within 10 miles of the Cibola (adapted from https://nmfwri.org/gis-projects/nm-vegetation-treatment-mapping)

Status	Name of Treatment	Land-owner	Partners in accomplishing work	Treatment Description	Target Species or Existing Vegetation	Acres
ongoing	Isleta Collaborative Restoration	USFS	Isleta Pueblo	Thinning, prescribed fire	Ponderosa, Pinyon, Juniper	31
planned	Alamo Navajo	Tribal: Alamo Navajo	Alamo Navajo	Thin and lop, harvest and remove, mastication	NA	10
planned	Bluewater Project, State Land Office	State	State Lands Office	NA	NA	279
planned	Bluewater Project, State Land Office	State	State Lands Office	NA	NA	622
planned	Bluewater Project, State Land Office	State	State Lands Office	NA	NA	342
planned	Bluewater USFS Cibola	USFS	NMSF/Cibola NF: Mt Taylor RD	Mechanical	NA	48
planned	Bluewater USFS Cibola	USFS	NMSF/Cibola NF: Mt Taylor RD	Mechanical	NA	33
planned	Bluewater USFS Cibola	USFS	NMSF/Cibola NF: Mt Taylor RD	Mechanical	NA	36
planned	Bluewater USFS Cibola	USFS	NMSF/Cibola NF: Mt Taylor RD	Mechanical	NA	21
planned	Bluewater USFS Cibola	USFS	NMSF/Cibola NF: Mt Taylor RD	Mechanical	NA	182
planned	Cerro Comadre	BLM	Rio Puerco Field Office	Thinning	NA	41
planned	Claunch-Pinto Estancia Basin	Private, State, County	Bernalillo District N6S	Thinning	NA	10
planned	Datil	BLM	Socorro Field Office	Thin, pile, remove	NA	250
planned	East Magdalena	USFS, BLM	Cibola NF/BLM Socorro Field Office	Prescribed fire	Forest treatment	8,100
planned	Magdalena	BLM	Socorro Field Office	N/A	Forest treatment	100
planned	Manzano State Park	State	Bernalillo District N6S	Thinning	NA	10
planned	Mesa Chivato	BLM	Rio Puerco Field Office	N/A	NA	3,000
planned	Pie Town	BLM	Socorro Field Office	Prescribed fire, masticate	NA	470

Status	Name of Treatment	Land-owner	Partners in accomplishing work	Treatment Description	Target Species or Existing Vegetation	Acres
planned	San Ignacio	BLM	Socorro Field Office	Thin, pile	Forest treatment	10
planned	Wildhorse	BLM	Socorro Field Office	Prescribed fire	Forest treatment	170
planned	Wolf Wells	BLM	Socorro Field Office	Thin, remove	NA	850
planned	Zuni Mountain	BLM	Rio Puerco Field Office	Thinning	Forest treatment	100
planned	Seferino Hill	BLM	NA	Pesticide	Creosote bush	432

USFS = U.S. Forest Service; BLM = Bureau of Land Management; NMSF – New Mexico State Forestry Division; RD = Ranger District; NA means information was unavailable at time of download.

Water Resources

Affected Environment

The affected environment for water resources includes riparian areas, surface water resources such as streams and springs, groundwater, and watersheds. Additional detailed information on water resources can be found in volume II of the assessment report prepared in support of the land management plan (USDA Forest Service 2015b). Not all resources are carried through the analysis of effects.

Riparian Areas

Riparian areas are defined as "three-dimensional ecotones (the transition zone between two adjoining communities) of interaction that include terrestrial and aquatic ecosystems that extend down into the groundwater, up above the canopy, outward across the floodplain, up the near-slopes that drain to the water, laterally into the terrestrial ecosystem, and along the water course at variable widths" (36 CFR 219.19). In the plan area, riparian areas includes wetlands and are largely associated with streams and springs.

In Arizona and New Mexico, an estimated 80 percent of all vertebrate species use riparian areas for at least half their life cycles, and more than half of these are totally dependent on riparian areas (Chaney et al. 1990). According to the Arizona Riparian Council, 60 to 70 percent of the state's wildlife species depend on riparian areas to sustain their populations, even though riparian habitats occupy less than half a percent of the land area (Arizona Riparian Council 1995). Similar numbers can be assumed for New Mexico. Likewise, aquatic and fish productivity are directly related to a properly functioning and healthy riparian habitat. These areas are typically, but not always, characterized by vegetation and animal communities associated with water such as phreatophytic plants like willows and sedges. They experience routine inundation by water during seasonal high flows and storm events.

The most current information about the location of riparian areas on the Cibola is available from the Regional Riparian Mapping Project (Triepke et al. 2013). There are 7,519 acres of riparian areas (using the RMAP data) occurring in the four mountain districts, represented by 12 types as shown in table 19. This is approximately 0.5 percent of the plan area. Some patterns are evident in this data. The San Mateo Mountains and the Zuni Mountains have a larger proportion of the mapped riparian areas within the plan area. Herbaceous riparian is the most common type, largely located in the Zuni Mountains.

Table 19. Riparian types in the plan area

RMAP Type	Acres	Percent
190 - Herbaceous Riparian	2,539	33.8
260 - Rio Grande Cottonwood / Shrub	2,051	27.3
230 - Narrowleaf Cottonwood / Shrub	1,240	16.5
290 - Willow - Thinleaf Alder	725	9.6
350 - Ponderosa Pine / Willow	458	6.1
280 - Upper Montane Conifer / Willow	215	2.9
150 - Fremont Cottonwood - Conifer	123	1.6
180 - Fremont Cottonwood / Shrub	54	0.7
170 - Fremont Cottonwood / Oak	48	0.6
130 - Desert Willow	35	0.5
110 - Arizona Alder - Willow	22	0.3
300 - Arizona Walnut	9	0.1

Quantitative assessment information for reference condition of riparian areas in the plan area is not available; therefore qualitative statements are made. Reference condition is assumed to be in proper functioning condition (USDI Bureau of Land Management 1998). Riparian-wetland areas are functioning properly when adequate vegetation, land form, or woody material is present to dissipate stream energy during high flows, filter sediment, capture bedloads, aid in floodplain development, improve flood-water retention and ground water recharge, develop root masses that stabilize streambanks, and develop diverse characteristics which provide habitat to support greater biodiversity within their potential to achieve this condition (USDI Bureau of Land Management 1998). Assessment of proper functioning condition involves understanding the attributes and processes that occur in that particular riparian area such as hydrology, vegetation, soil processes. In addition, riparian area have successional state that occur as systems are disturbed and recover. Each of these states have different characteristics depending on their capability and potential. In general, riparian areas should be able to access their floodplain if they have one, be in balance with the landscape setting in terms of sinuosity, width-to-depth ratio, and gradient. This leads to vertical stability with natural lateral stream movement where appropriate. The floodplain should be able to dissipate the energy of floods or high water events. It is important for vegetative characteristics to include a diverse age class distribution and composition of vegetation, species that indicate maintenance of riparian soil moisture characteristics, high vigor, and vegetation that protects streambanks. In addition, where the potential exists, riparian vegetation should be an adequate source of coarse woody material, large woody material, or both. By having these characteristics, a riparian area is resilient during floods, high-water events, or both. This resiliency allows an area to provide desired values, such as fish habitat, Neotropical bird habitat, or forage over time.

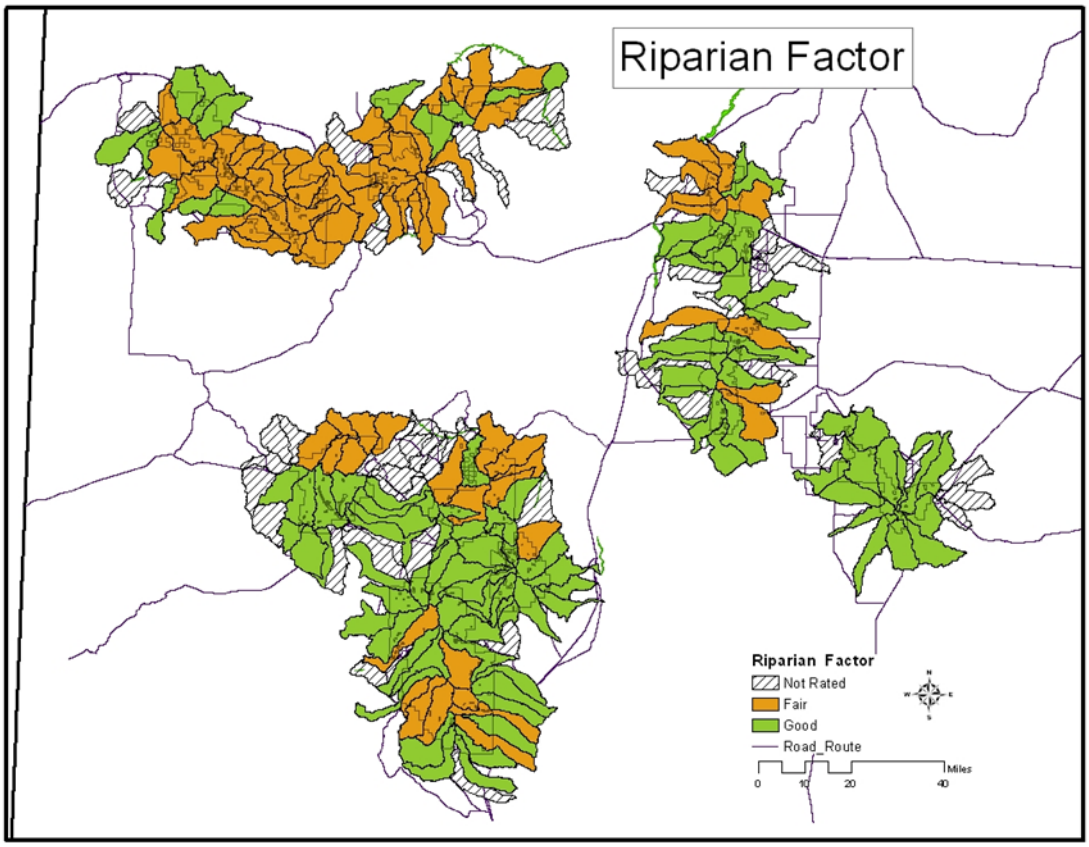


Figure 2. Riparian condition from the watershed condition assessment for the planning area

The condition of Cibola riparian areas was estimated during the classification of watershed condition (USDA Forest Service 2011c) using available data and field observations. Where available, this assessment used proper functioning condition assessments to determine the condition rating for the riparian indicator.

Riparian areas in the plan area were rated as good or functioning properly on 96 (46 percent) of the 12-digit subwatersheds. A fair rating, functioning at risk, was given to 70 (34 percent) of the sub-watersheds. None of the watersheds were rated as poor or impaired. Forty-two (20 percent) subwatersheds were not rated since these watersheds have less than 10 percent of their area within the plan area, even if these sub-watersheds had riparian areas in them. Where no mapped riparian areas exist within a watershed, a rating of good was assigned, unless the subwatershed was not rated due to less than 10 percent National Forest System lands.

Many riparian areas on the Cibola are currently at risk as discussed in the assessment report. Some areas with the potential for riparian vegetation do not have characteristics associated with riparian areas. This is largely a function of legacy issues related to livestock use, water development and diversion, roads (authorized or otherwise), developed recreation, dispersed recreation, herbivory by wildlife, both on and off the Cibola. Of these factors, herbivory is the greatest impact as most riparian areas show a lack of younger age classes as shown by existing proper functioning condition assessments. The lack of clear direction and implementation of riparian buffers has also contributed to impaired riparian conditions as shown by monitoring of riparian areas and vegetation management projects. On the Sandia Ranger District, where livestock grazing is not permitted, riparian areas are recovering at rates greater than the rest of the plan area as evidenced by visual observations and proper functioning condition assessment.

Recreational use and water withdrawals in the Sandia Ranger district are the greatest impacts there. Riparian areas can also be impacted by climate trends such as drought and cycles of erosion and deposition. Changes to the disturbance regimes of riparian areas also impact riparian areas. Flooding and fire are the most common disturbances found in riparian areas. Disturbance in riparian areas can create landscape elements such as pockets of remnant vegetation, sediment deposits, and large woody material. Generally, riparian areas are subject to disturbance less often than the uplands around them due to their higher moisture content.

Surface Water Resources

Surface water resources include streams and springs. Streams are classified by their flow characteristics into perennial, intermittent, and ephemeral types. These flow types provide information about the timing of water within the streams. Miles of mapped stream types were calculated using the National Hydrography dataset as reported in the assessment report with available forest updates.

- **Perennial streams** flow year-round because they get water from water storage in the ground. However, these streams may dry up during extreme droughts. There are 25 miles of mapped perennial streams in the plan area.
- **Ephemeral streams** only flow in direct response to precipitation or snowmelt. There are 5,334 miles of mapped ephemeral streams in the plan area.
- **Intermittent streams** fall between ephemeral and perennial. These types of streams get water from the ground seasonally and usually dry up in the summer. There are 845 miles of mapped intermittent streams in the plan area.

Perennial and intermittent streams support riparian vegetation. Intermittent and ephemeral streams provide many of the same ecosystem goods and services as perennial streams (Levick et al. 2008). All streams are pathways for the movement of water, nutrients, and sediment throughout the watershed. Intermittent and ephemeral streams comprise a large portion of the stream network within watersheds. These features have greater relative moisture than the surrounding area, often stored in ground. In addition, when these features erode and downcut, gullies can form. This leads to soil and wetland loss and the surrounding water tables get deeper (Schumm et al. 1984).

The National Hydrography dataset was used to provide data about water resource features in the plan area. There are 6,203 miles of mapped stream channels in the plan area. Intermittent streams account for 845 miles. There are 5,334 miles of mapped ephemeral channels. Mapped perennial streams occur on 24.8 miles across 15 of the 208 subwatershed in the plan area. This shows how uncommon perennial water is. This low abundance of perennial streams is due to evaporation that is much greater than precipitation in the entire state of New Mexico (NOAA 1985). There are unmapped perennial waters in smaller locations since perennial streams are often located along very short stretches. It is not known whether this amount of water has changed from historic conditions. However, due to incisement of stream channels, much of which occurred in the late 1800s to early 1900s, water tables have lowered in many of the streams, which likely resulted in reduced perennial and intermittent flows (Scurlock 1998).

The desired condition for streams and springs is properly functioning, water quality standards are met, and water withdrawals do not impact beneficial uses. Stream and spring condition are assessed using the proper functioning condition method (USDI Bureau of Land Management 2003).

This method qualitatively evaluates hydrologic function, vegetation, and erosion or depositional processes to determine if the stream or spring has the necessary attributes to dissipate energy associated with water and wind action, filter sediment, improve water retention, resist erosion, and provide habitats for biodiversity. Similar to the watershed condition rating, the ratings are properly functioning, functioning at risk, or nonfunctional. Four of the mapped perennial streams have been assessed using the proper functioning condition method. All of these streams were determined to be functioning at risk.

Two of the perennial streams have been assessed by the State of New Mexico (New Mexico Environment Department 2012) and are listed as impaired. Notably, Las Huertas Creek and Bluewater Creek are listed as impaired. The portion of Bluewater Creek assessed by New Mexico is from Bluewater Reservoir to the headwaters of Bluewater Creek, assessment unit NM-2107.A_01. The designated use of coldwater aquatic life is not supported in this reach as indicated by a nutrient and temperature data collected in 2006. Possible sources of impairment include: forest roads, loss of riparian habitat, rangeland grazing, silviculture harvesting, and streambank modification/destabilization. Las Huertas Creek, the perennial portions in the reach from Santa Ana Pueblo to the headwaters (assessment unit NM-2108.5_00) were last assessed by New Mexico Environment Department personnel (2012) in 2008. The designated use of high quality coldwater aquatic life is not supported in this reach as determined by nutrient and turbidity indicators. Probable sources of impairment include flow alterations from water diversions, on-site treatment systems, streambank modifications and destabilizations, waste from pets, and unknown sources.

There are also several designated outstanding national resource waters, as designated by New Mexico Environment Department personnel, within the plan area. All are within the Apache Kid Wilderness in the San Mateo Mountains on the Magdalena Ranger District. Smith Canyon and Indian Creek have been designated as outstanding national resource waters streams. These segments are 1.4 miles each, for a total of 2.8 miles. Sixteen areas within the Apache Kid Wilderness have been designated as outstanding national resource waters wetlands, totaling 21.9 acres. Nonpoint sources of pollution in these areas must be minimized and controlled through the use of best management practices.

Springs on the Cibola National Forest are a valuable but limited resource. Water in springs comes from groundwater. The flow paths through the subsurface are complex and can take from weeks to years to travel to the point of emergence (Stevens and Meretsky 2008). Water from springs supports ecosystems, often in locations where no other water is available. Consequently, these areas are very important for supporting plants and animals in these areas.

On the Cibola, springs are often the only natural water source during the summer. These springs supply water to streams and support much of the perennial flow within the plan area. There are 367 mapped springs within the plan area based on the current National Hydrography dataset. There are only 3 springs in the Gallinas Mountains, while the Manzanos have 84 springs. The character of the springs is not well known. It is likely many of these springs are dry or only flow for short periods of time, or flow in high precipitation years.

Over eighty percent of the streams on the Cibola's mountain districts depend on springs for their water flow. In addition, over eighty percent of the springs in the plan area have been developed for consumptive uses, mostly for livestock use. In these areas, the ecosystem associated with the spring has been reduced or lost due to this use. Since springs are supplied by waters which emerge from the ground, and have been filtered through soil and bedrock, the water quality tends to be good and meets water quality standards. It is likely that some springs have higher concentrations of trace elements (such as arsenic) but these are related to bedrock chemistry, rather than contaminants from management activities.

Watershed Condition

A watershed is a region or land area drained by a single stream, river, or drainage network. These drainage areas are determined by topography so that a drop of water falling inside the boundary will flow to a selected point on a stream. Because of this, watershed boundaries cross ownership boundaries. There is an established method for delineating watershed boundaries which is defined by a number code called the hydrologic unit code. Each two digits in the number system represent a drainage basin, with successive numbers referring to smaller watersheds nested within the larger one. On the Cibola, the plan area is located within portions of sixty 5th (10-digit) hydrologic unit code watersheds. Nested within these larger watersheds are 208 individual 6th-code (12-digit) subwatersheds that intersect the plan area.

The Watershed Condition Framework is an analysis methodology developed by the Forest Service to classify the functioning of sub-watersheds which have more than 10 percent of their area within the plan area (Potyondy and Geier 2011). The condition rating only applies to the National Forest System lands within each watershed. Twelve indicators are used to classify watershed condition into three categories:

- **Class 1 (properly functioning - good)** – Watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition, and they are functioning properly.
- **Class 2 (functioning at risk - fair)** – Watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition, and they are functioning, but at risk.
- **Class 3 (impaired function - poor)** – Watersheds exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition, and their function is impaired.

Watersheds with characteristics (and hydrologic processes) closer to the naturally pristine state are likely to be properly functioning, whereas those that have been severely altered are more likely to be degraded (resulting in impaired function). The desired condition for watersheds on the Cibola is properly functioning. Using this system, 119 subwatersheds are functioning properly, 46 subwatersheds are functioning at risk, and 1 subwatershed is impaired. Forty-two watersheds were not rated since these watersheds have less than 10 percent of their area within the plan area.

The twelve indicators used to classify subwatersheds are in four groups: aquatic physical, aquatic biological, terrestrial physical, and terrestrial biological. In the Cibola, the main indicators that contribute to the impaired watershed condition are roads and trails, soils, and fire regime or wildfire. In addition, aquatic habitat, riparian areas and wetlands, soils, fire regime, and rangeland vegetation indicator are rated as at risk in a majority of subwatersheds. The number of subwatersheds with indicators functioning at risk or with impaired function indicates there is a need to restore ecosystem resiliency across the landscape. A full listing of the subwatersheds and their condition indicator ratings appears in the assessment report.

Currently, there are six subwatersheds that have an overall fire regime condition class rating of Class 1, meaning most of the acres in these watersheds are within the natural range of variation. Sixty two sub-watersheds have overall ratings of class 2, where there is a moderate departure from reference conditions. Ninety eight sub-watersheds have an overall rating of class 3, with a high departure from reference fire conditions. Across the plan area, 13.8 percent is in fire regime condition class 1, 65 percent is in fire regime condition class 2, and 21.2 percent is in fire regime condition class 3. Improvements to the fire regime condition class from the proposed management alternatives could improve fire regime condition class classes by improving vegetation characteristics such as composition, structure, and fire intervals through vegetation management activities, including mechanical treatments, prescribed fire, and managed wildfire.

Groundwater

Groundwater is an important component of water resources on the Cibola National Forest. Much of the water on the Cibola comes from groundwater resources. Aquifers are underground areas where water occurs in rock formations. The mountains on the Cibola provide water for recharging many aquifers in the region.

The Cibola is within seven groundwater basins identified by the state of New Mexico (NMOSE 2006). These seven are identified as Bluewater, Estancia, Gallup, Rio Grande, Roswell, Sandia, and Tularosa.

Groundwater recharge depends mostly on precipitation which is greatest at the higher elevations within the plan area. In the summer, recharge occurs when summer precipitation collects in channels and then infiltrates through the bed to the ground in wet years (McCoy and Blanchard 2008). In the winter, precipitation can percolate through the soil cover (Titus 1980).

Groundwater flows out from the mountains from all sides; generally, this is the main source of water for the aquifers in the region. Because of this, recharge in the mountains of the Cibola National Forest is very important to the groundwater resources of the region. One study showed recharge from monsoon rains reaches aquifers on the eastern slopes of the Sandia Mountains one to five months afterwards (McCoy and Blanchard 2008). Wells within the Tijeras Graben, to the east of the Sandia Mountains, do not appear to be related to individual precipitation events, meaning these areas could be at risk for groundwater depletion.

Mountain front recharge and recharge through arroyos occurs when water runoffs into channels, usually during high precipitation events and snowmelt. The amount of water involved in these events is related to seasonal weather patterns in the short term and climate in the long term. Drought reduces the amount of water available for runoff. Climate change could also have this effect.

Methodology and Assumptions

This section includes assumptions common to all water resources including surface water, watersheds, and riparian areas and specific assumption to each resource.

Assumptions

Assumptions for Riparian Areas

- Analysis of riparian areas encompasses all riparian types, so the assumption is that potential effects from the implementation of the draft land management plan alternatives are similar across all the different riparian types.
- Mechanical vegetation treatments in riparian management zones are designed to benefit the riparian area. These activities often occur concurrently with the larger vegetation treatment projects but have different prescriptions to improve riparian conditions.
- The draft land management plan alternatives propose objectives for watershed improvement projects by the number of projects. Restoration in riparian areas is part of these objectives.
- The restoration activities described in the alternatives including forest thinning, prescribed fire, and watershed restoration projects will occur where needed to achieve desired conditions. Not all sites that need maintenance or improvement will be treated due to the large number of opportunities for restoration.

Assumptions for Surface Water

- The restoration activities described in the alternatives including forest thinning, prescribed fire, and watershed restoration projects will occur where needed to achieve desired conditions. Not all sites that need maintenance or improvement will be treated due to the large number of opportunities for restoration. The specific locations and designs of these activities are not known at present.

Assumptions for Watersheds

- It is assumed the mechanical vegetation treatments overlap with the prescribed fire treatment acres.
- Vegetation treatments and fire will improve those acres to fire regime condition class 1.
- The fire regime condition class will not decrease within fifteen years, based on fire return intervals and vegetation characteristics.
- Fire regime condition class 2 and 3 are concentrated in the ponderosa pine and mixed confer vegetation types.
- Vegetation and fire levels and management strategies proposed in the alternatives vary by alternative. Alternative C proposes to focus restoration activities in a restoration management area. For alternative C, it is assumed treatments will occur in watersheds that intersect the proposed restoration management areas.

Spatial and Temporal Bounds of Analysis

Surface Water and Riparian Areas

The alternatives are analyzed within a 15-year period since this is the same duration as the plan and effects could be evident from implementation within this time. The spatial extent are those surface waters and riparian areas that are within the plan area since these are the features that could be affected by the proposed alternatives.

Watersheds

The timeline is 15 years, the life of the land management plan, since this is the period in which the proposed activities could occur. In addition, 15 years is not enough time for the fire condition class to worsen, based on fire return intervals and vegetation characteristics. The extent are the National Forest System lands within the rated 12-digit hydrologic unit code subwatersheds that intersect the plan area. This scale was selected because this the scale at which watersheds are rated for watershed condition using the Watershed Condition Framework (Potyondy and Geier 2011).

Effects Indicators

Three indicators were used to examine potential effects to riparian areas and surface water resources: restoration treatments, water resource improvement activities, and livestock management. These indicators and types of effects for each are described in table 20. Restoration is a good measure of impacts to watershed function because it can have long-term benefits as well as short-term adverse effect (for example, soil compaction, erosion, sedimentation) (USDA Forest Service 2010b). Restoration activities could include mechanical forest thinning, temporary roads associated with thinning, prescribed burning, and managed wildfire. Water resource improvement activities include stream channel restoration, riparian restoration, and road decommissioning. Livestock management includes range improvement activities and management actions. All of these activities have standards and guidelines associated with them in the alternatives for the land management plan.

The indicator used to assess watershed condition is the proposed restoration treatments because these activities have the potential to improve watershed condition. Restoration as described in each alternative were chosen as the indicator for watershed condition because the number of acres proposed for these indicators have the potential to change watershed condition by changing the predominant fire regime condition class rating to class 1. Other restoration activities such as watershed improvement projects would not have the potential to change overall watershed condition due to the low levels proposed in each alternative. Proposed changes to livestock management would not move watershed condition classes within the analysis timeframe. While the vegetation treatments and fire activities may not be of the magnitude to cause a shift in the actual watershed condition as determined by the Watershed Condition Framework (Potyondy and Geier 2011), this indicator provides information how each alternative supports moving watersheds towards properly functioning condition.

Table 20. Indicators and associated effects

Indicator	Effect
Restoration treatments (includes mechanical thinning and associated temporary roads; prescribed fire)	Loss of canopy vegetation, changes to ground cover, water quality changes, changes to stream flows, changes in channel characteristics, changes in riparian condition, erosion, sedimentation, changes to watershed condition
Water resource improvement activities (includes road decommissioning)	Loss of canopy vegetation, changes to ground cover, water quality changes, changes to stream flows, changes in channel characteristics, changes in riparian condition, erosion, sedimentation, changes to watershed condition
Livestock management	Loss of canopy vegetation, changes to ground cover, water quality changes, changes to stream flows, changes in channel characteristics, changes in riparian condition, erosion, sedimentation, changes to watershed condition

Environmental Consequences

The relationship between effects to water resources, riparian areas, and watersheds from roads, vegetation treatments, prescribed fire, and livestock use effects to water resources is well documented (USDA Forest Service 2005, USDA Forest Service 2001, Binkley and Brown 1993, EPA 1973). These effects include loss of vegetation, compaction, increased runoff, erosion, water quality changes, and changes to the condition of water resource features such as riparian areas and springs. Standards and guidelines, as proposed by each of the action alternatives, would be used to reduce this type of effects to water resources. However, other than complete avoidance, these practices are not 100 percent effective even when implemented (USDA Forest Service 1989, USDA Forest Service 1994a, Cristan et al. 2016). In addition, monitoring on the Cibola National Forest (Cibola National Forest plan monitoring reports 2010 to 2015) has shown best management practices are not always implemented or effective, resulting in effects to resources.

Activities that occur within the plan area, such as the activity and presence of wildlife, dispersed and developed recreation, special uses, mining, and groundwater use, are not carried through the following analysis of the alternatives since there is little difference between the alternatives and the existing condition in terms of effects to water resources. This is because some resources are common across all management areas such as wildlife. Wildlife is not carried through because while the activity and presence of plants and animal has an effect on water resources, this effect will not vary from the existing condition and the proposed alternatives. Trees and other forest vegetation is managed through the forestry program and often includes objectives for wildlife but this effect is covered under the vegetation treatments activity.

Herbivory related to wildlife does not vary since wildlife numbers of the main grazers such as deer and elk are managed through New Mexico Fish and Game. Recreation is not included since trails, developed sites, and dispersed use do not vary greatly between alternatives in terms of water resources. Motorized trails are included with roads due to the similar effects to water resources and the different potential activities allowed in the different management areas. The effects of special uses are guided by best management practices provided for in the land management plan standards and guidelines. Mining is also not carried through the analysis of alternatives because there is no difference between alternatives regarding the location of mining activities.

Groundwater withdrawals for Forest Service uses were also not carried through the analysis since there are standards and guidelines to avoid this effect and the State of New Mexico largely regulates this use. Forest Service groundwater policy (Forest Service Manuals 2560 and 2880) as well as agency technical guides, provide direction for well drilling and pumping on the Cibola, specifying that these activities must not adversely affect connected riparian habitat and water quantity and quality. However, within the Cibola, special use authorities can be used to locate wells away from areas where groundwater withdrawals could have an impact such as riparian, springs, and stream channels. Because direction in the Forest Service manual is considered adequate and groundwater withdrawal is governed by State regulations, additional management direction is common to all action alternatives and they are not analyzed in this environmental impact statement.

Effects Common to All Water Resources

Effects common to all alternatives consist of potential adverse or beneficial impacts to water resources from the indicator of restoration activities and associated heavy equipment use and temporary roads, watershed improvement activities, and livestock management. This analysis provides a qualitative assessment of forecasted trends in surface water quality, water quantity, and hydrologic function for surface water in relation to various restoration management activities. The restoration activities analyzed include potential impacts to surface water from vegetation management treatments such as mechanical thinning, prescribed burning, and managed wildfire; road improvement projects; invasive species removal projects; as well as water resource improvement activities such as road decommissioning.

Restoration Treatments

Mechanical forest thinning, prescribed burning, and managed wildfire should reduce the likelihood that catastrophic wildfire will occur (Agee and Skinner 2005), benefitting surface water resources through maintaining ground cover. Adequate groundcover reduces erosion potential by slowing the flow of water over the landscape and adding root strength to the soil. Indirectly these activities maintain water storage capacity while also reducing erosion and sedimentation (Johansen et al. 2001).

Managed wildfire could occur anywhere within the plan area and therefore could impact all of the watershed resources described in this section. Since managed wildfire is dependent on climate and weather conditions as well as fire condition regimes, it is unknown to what extent this would occur over the life of the plan. However, objectives for managed wildfire have been developed for the proposed alternatives based on previous year averages of wildfires that have occurred and management wildfires for resource benefit, based on each alternative theme.

Fire may cause adverse effects to water resources such as riparian areas if fire severities are high or occur more frequently than is natural. These effects include species composition and structural changes, soil impacts, high flood flows, and vertical and lateral instability.

Heavy equipment use in sensitive areas such as riparian areas and stream channels disturbs vegetation and soil as they move across the project area resulting in bare areas that are likely to channelize water, making it more susceptible to erosion (USDA Forest Service 2010b). Loss of vegetation can impact riparian structure and composition and leave streambanks, shorelines, and wet areas without the protection required to dissipate high flows.

Heavy equipment use for restoration action including road decommissioning will temporarily increase ground disturbance and may increase erosion causing sedimentation into the adjacent water resource feature. Sediment and turbidity adversely affect water quality, aquatic habitat, and flood capacity by making water more difficult to clean, decreasing the oxygen supply to fish and amphibians, and decreasing habitat diversity and availability volume (Henley et al. 2000; Postel and Thompson 2005).

As part of vegetation management operations, the construction of temporary roads is often required to mobilize the equipment to the project area and haul materials away. Temporary roads are similar to permanent roads in that they require soil disturbance, compaction, and drainage manipulation. Roads can be significant sediment sources to water bodies (USDA Forest Service 2001) because soil disturbed during construction (for example, cut and fill) and use is more susceptible to being entrained by water flowing across the ground surface. Where surface water enters a stream channel (for example, at a cross-drain), the eroded soil is introduced to the hydrologic network. Sediment contributions from roads can be extreme where culverts are plugged and stream flow is either diverted down the road, or the road fill at the stream crossing is eroded and delivered to the channel below. Excessive sediment adversely affects aquatic habitat and causes channel aggradation, which ultimately decreases flood capacity.

Where roads cross stream channels with culverts, low water crossings, and bridges they can interrupt geomorphic (and biologic) connectivity (Gucinski et al. 2001). Where culverts are improperly sized or placed at the wrong gradient, they can physically and hydraulically prevent the passage of water, sediment, and wood downstream. These stream crossings can cause persistent adverse effects such as erosion, gullying, and sedimentation.

Where roads or infrastructure such as power lines parallel stream channels or frequently cross them, the reduction in vegetation can affect stream shade (USDA Forest Service 2001), leading to increased stream temperature. Elevated water temperature adversely affects cold water aquatic habitat and other aspects of water quality (for example, dissolved oxygen). In addition, vegetative composition and structure is affected in riparian areas leading to changes in proper functioning condition.

Water Resource Improvement Activities

Appropriate treatments such as thinning, removal of old infrastructure, and fencing in the riparian management zone will improve vegetative composition and structure by allowing for natural processes to establish.

Water resource restoration actions include a suite of possible activities that have the beneficial effect of rehabilitated geomorphic and biological processes, which would help to restore stream and riparian ecosystem services. Properly functioning streams and riparian areas provide clean water, regulated water temperature, water storage, sediment storage, nutrient cycling, and good habitat (Gregory et al. 1991). Road decommissioning is a common restoration practice which involves using heavy equipment to treat the road prism to reduce erosion and hydrologic impact. Levels of treatment range widely, but generally requires decompacting the road and may involve removing the road prism and reshaping the area to match natural hillslope contours. Planting, seeding and grading are rehabilitation activities commonly associated with larger restoration projects.

Road management is a good measure for impacts to water resources since many roads in the plan area are located within 300 feet of a water resource. Roads concentrate runoff, cause persistent sediment and stability issues at stream crossings, and result in loss of vegetation along their right of way. These effects result in reduced proper functioning condition, as well as water quality impacts and habitat loss. Road decommissioning reverses these effects.

Livestock Management

There are numerous effects related to livestock use within the plan area. As described in the assessment report, livestock use has several impacts to riparian areas, surface water resources, and watersheds. This is related to changes in ground cover, loss of riparian vegetation and vigor, compaction, erosion, streambank impacts, water quality changes, and water developments for livestock. These effects are well documented (Belsky et al.1999; Kauffman and Krueger 1984), and this results in adverse effects to riparian areas, surface water resources, and watershed condition, largely through trampling and herbivory. Loss of riparian ecosystems also occurs when surface water resources are diverted for livestock watering, resulting in dewatered streams and springs that can no longer support riparian vegetation.

Livestock herbivory in riparian areas decreases structure, diversity, and vigor of riparian vegetation. This includes loss of riparian vegetation. Where riparian plants have been diminished or eliminated, other attributes are affected. Riparian plants provide stabilization for streambanks and channels, shade, energy dissipation for floods, nutrient controls, and filtration of pollutants. As a result, loss of this riparian vegetation reduces these benefits, resulting in riparian areas that are not properly functioning and are at risk of being lost. During flood flows, riparian plants protect the streambanks by covering the banks and slowing flood flows. They trap sediment, rebuild and expand floodplains, raise the water table, and expand riparian communities. Larger and well vegetated floodplains retain water longer (Tabacchi et al. 2000), raising stream baseflow during the driest part of the year. Livestock adversely affect stream channel form, process, function, and habitat where they have diminished or eliminated woody riparian species. Livestock trampling also reduces riparian vegetation and changes soil properties in riparian areas. This leads to areas of bare soil, destabilized channels, erosion, sedimentation, and changes to infiltration of water. Livestock hooves and body weight alone easily collapse and otherwise erode stream banks as they trail along, cross, and drink from streams. Compaction also occurs, resulting in decreased infiltration and impacts to ground cover. This diversity is critical to aquatic habitat. Their hooves and body weight alone easily collapse and otherwise erode stream banks as they trail along, cross, and drink from streams. Where water has been developed from surface water sources for livestock watering, riparian areas have lost vigor and disappeared due to lack of water. This is especially true where springs have been developed without providing water for the associated ecosystem.

Livestock grazing can also adversely and directly affect water quality (Armour et al. 1994). This can be from sediment mobilized from trampling near surface waters but also is related to pathogens and nutrients from animal waste. Where animals concentrate at stream channels and springs they are most likely to contaminate surface waters. The majority of livestock generated pollution is related to soil disturbance and erosion. Soil becomes compacted in areas where livestock habitually congregate. Compacted soil is less hospitable to plant roots than uncompacted soil. Where plant roots are unable to penetrate the soil they are less able to take in nutrients and water, making plants more vulnerable to toppling, disease, and drought, as well as decreasing bank strength (Abernethy and Rutherfurd 2001), causing streams to become more susceptible to erosion.

Through their feces and urine livestock contribute nutrients and organic matter (Sheffield et al. 1997), bacteria (for example, *Escherichia coli*) (Davies-Colley et al. 2004) and protozoan pathogens (for example, Giardia) (Nader et al. 1998) to stream channels. Nutrient addition to surface waters, particularly phosphorus and nitrogen, can increase algal growth, decrease water clarity, and increase ammonia concentrations which can be toxic to fish. The increased organic matter also serves as a food source for bacteria and other microorganisms, resulting in lower oxygen levels in the water. Bacteria and protozoan pathogens can be harmful to humans and wildlife. Livestock grazing can adversely affect stream temperature (Beschta 1997). Where stream channels lack significant vegetative cover due to grazing, solar exposure may warm surface water, harming cold water dependent aquatic species.

When livestock use has contributed to loss of riparian areas, decreased water quality, and impaired soil condition, watershed condition is affected. Many of the factors used to determine watershed condition using the Watershed Condition Framework (Potyondy and Geier 2011) have a relationship to livestock use and effects across the landscape. Rangeland vegetation, riparian vegetation, aquatic habitat, and water quality are part of this methodology. Loss of riparian vegetation, reduced ground cover, and consumptive use of water related to livestock use contributes to watershed conditions that are less than satisfactory.

Riparian Areas

Riparian areas are found around springs, perennial and intermittent streams, waterbodies, and wetlands. Data for riparian areas in the plan area are found in the Regional Riparian Mapping Project GIS dataset. There are additional unmapped riparian areas located in the plan area. The discussion on riparian areas is focused on the condition of riparian areas. The analysis area is the riparian areas within the plan area. The timeframe is fifteen years, the expected duration of the proposed plan.

Potential effects to riparian areas from plan-guided management actions proposed in the alternatives are measured using appropriate indicators. The effects of proposed management actions including land management plan components and management areas that have the potential to affect riparian areas in positive and negative ways. The attributes of riparian areas that could be affected are impacts to properly functioning condition by reducing riparian vegetation, impacts to associated stream or spring features, erosion, changes in stream flows, protection from uncharacteristic wildfire, and other effects. In addition, properly functioning riparian areas should have vegetative structure and composition that reflect the potential of that riparian area. The alternatives will be assessed on how they will move riparian area towards proper functioning condition including desired vegetation and structure.

Mechanical vegetation treatments use heavy equipment such as skidders during operations. Potential effects from this activity include vegetation and soil disturbances. Bare areas are created when this heavy equipment moves across the land, removing vegetation and compacting soil. These areas concentrate water, leading to erosion and sedimentation in the riparian area. These potentially adverse effects are possible during mechanized activities in riparian areas where allowed. Guidelines limit the extent and use of heavy equipment in riparian areas to specific conditions such as temporary crossings.

Heavy equipment may be used during these activities by increasing ground disturbance and increasing erosion. However, these effects are expected to be short term in duration whereas benefits of restoration treatments and watershed improvement projects are long term.

Targeted removal of nonriparian species by vegetation treatments and fire, especially from herbaceous riparian types, assists in moving these areas towards the appropriate desired condition.

Indicator: Restoration Treatments

Restoration activities within this indicator include prescribed burning and vegetation treatments.

Alternative A: Riparian Areas

Alternative A represents the 1985 plan, as amended. This alternative provides standards and guidelines for riparian areas to ensure the management does not degrade riparian areas and meet satisfactory conditions as defined in this alternative. These guidelines provide measures for shade, bank cover, streambed sedimentation, plant composition, plant structure, crown cover, and ground cover. The use of best management practices, including the designation of stream courses during timber sales are standards. Another standard directs the maintenance and improvement of moderately high and high condition riparian areas and treatment in low to moderately low condition riparian areas.

In alternative A, 95 percent of all mapped riparian areas are located in management areas where mechanical vegetation treatments and prescribed fire could occur. Alternative A emphasizes mechanical timber sales, wildfire suppression, and range management. While riparian areas are generally not highly departed from reference vegetation composition and structure as a result of wildfire suppression, some sites especially herbaceous riparian types, may be departed due to unnatural levels of nonriparian vegetation. There are objectives for vegetation treatments (up to 5,000 acres) and fire (prescribed and managed wildfire up to 15,000 acres), but there isn't a focus on restoration for treating departed fire regimes.

There are no clear plan components in alternative A that prescribe buffers or a management zone for riparian areas. While there is mention of buffers for riparian areas in alternative A, it is scattered in other resources without a clear intent for protecting riparian areas across the Cibola during all management activities. Buffers are a very effective method for protecting the benefits of riparian areas, and the lack of direction in using buffers leads to degraded riparian areas from management actions. This has been shown by land management plan monitoring.

As a result, alternative A does not address the identified needs for change for riparian areas. While similar to alternatives B through D, the objectives for mechanical vegetation treatments and fire are not directed at areas where fire regimes are departed. As a result, fire could cause widespread impacts to riparian areas from higher intensity fire conditions that would be natural by increasing the frequency of fire in riparian areas which are historically low-frequency fire ecosystems. Guidance provided in alternative A for riparian areas in the 1985 plan is not clear or adequate to protect the proper functioning condition of riparian areas including the appropriate vegetative components.

Effects Common to Alternatives B, C, and D: Riparian Areas

Plan components directed at riparian areas are the same for alternatives B, C, and D. These include the establishment of a riparian management zone of at least one hundred feet unless site specific conditions determine other effective widths. Management activities such as restoration treatments in these zones should not degrade the attributes and promote the desired condition of riparian areas. Management activities in these zones should maintain or improve the age class distribution and diversity of native riparian plant species and allow for recovery, where needed, to sustain healthy conditions. In addition, there are guidelines to protect the hydrologic flows that sustain riparian areas. By including these components, there is a more comprehensive approach to protecting, maintaining, and restoring riparian areas.

Within riparian management zones, there are guidelines to ensure vegetation treatments are appropriate and benefit the proper functioning condition of these areas. These treatments are not the same treatments used in the uplands. There are standards and guidelines proposed in these alternatives that would work to reduce the effect of roads on riparian areas, including temporary roads in relation to vegetation management projects. These include designation of riparian management zones, locating roads away from riparian areas, and ensuring temporary roads are removed after use.

The emphasis is to restore landscape conditions through vegetation treatments using mechanized methods to thin overly dense stands of trees in the uplands. Fire is also an important tool in these alternatives with emphasis placed on the use of both prescribed and managed wildfire to improve fire condition regimes.

Alternative B: Riparian Areas

Alternative B has the potential to improve riparian conditions plan components, objectives, and management area designations. In addition, new management areas (such as 55,533 acres of recommended wilderness areas) are proposed that have land management plan components that would limit mechanical vegetation activities that can have negative effects from soil compaction and erosion.

To address the risk of uncharacteristic wildfire due to fire condition regimes that are departed from natural condition, there is an emphasis is on restoring vegetative conditions by mechanical vegetation treatments and prescribed fire across much of the plan area, largely in the ponderosa pine and mixed conifer types. The objective acres in this alternative are of mechanical vegetation treatment and acres of prescribed fire. In addition, wildfire will be managed, where possible, to further restoration efforts. In this alternative B, ninety-five percent of all mapped riparian areas are in management areas where mechanical vegetation treatments and prescribed fire could occur. In these areas, fire condition regimes would be improved, leading to reduced possibilities of uncharacteristically intense fires that would have impacts to riparian areas such as loss of vegetation and reduced functioning to dissipate floods and provide ecosystems functions. Mechanized vegetation treatments in riparian management zones would be uncommon under this alternative and guidelines ensure that, if planned, these activities would benefit the riparian area in the long term, with a few exceptions such as road crossings.

Alternative B does address the identified needs for change for riparian areas. There are improved plan components that provide direction, guidelines, and management approaches to maintain and improve the proper functioning of these systems including appropriate vegetative characteristics. The objectives for mechanical vegetation treatments and fire are directed at areas where fire regimes are departed and could occur across the plan area. As a result, the risk of fire that could cause widespread impacts to riparian areas by impacting the uplands or direct fire in the riparian area would be decreased. Riparian management zones provide for targeted treatments in these areas while protecting riparian values. However, because vegetation treatments could occur across a broad area, the effect of these treatments may be less effective without a landscape focus. Guidance provided in alternative B for riparian areas provides clearer direction for ensuring that proper functioning condition is maintained or improved.

Alternative C: Riparian Areas

Similar to alternatives B and D, alternative C has plan components, objectives, and management area designations that have the potential to improve riparian conditions. These include objectives for watershed improvement projects, improvement in the fire condition regimes through mechanical vegetation treatments, prescribed fire, managed wildfire, and improved range management. In addition, new management areas (such as 24,019 acres of recommended wilderness) are proposed that have land management plan components that would limit mechanical vegetation treatments and other activities that can have negative effects from soil compaction and erosion. Alternative C proposes a restoration management area across the plan area where restoration activities would be focused. This would allow for the targeted restoration resulting in a more effective strategy for restoring natural fire condition regimes.

In alternative C, 95 percent of all mapped riparian areas are in management areas where mechanical vegetation treatments and prescribed fire could occur. Forty percent of mapped riparian areas are within the proposed restoration management areas, making it more likely that these riparian areas will benefit. In these areas, fire condition regimes are improved, leading to reduced possibilities of uncharacteristically intense fires that would have impacts to riparian areas such as loss of vegetation and reduced functioning to dissipate floods and provide ecosystems functions. Mechanized vegetation treatments in riparian management zones would be uncommon under this alternative and guidelines ensure that, if planned, these activities would benefit the riparian area in the long term, with a few exceptions such as road crossings.

Alternative C does address the identified needs for change for riparian areas. The objectives for mechanical vegetation treatments and fire are directed at areas where fire regimes are departed within the restoration management areas. As a result, the risk of fire that could cause widespread impacts to riparian areas by impacting the uplands or direct fire in the riparian area would be decreased. Riparian management zones provide for targeted treatments in these areas while protecting riparian values.

Alternative D: Riparian Areas

Similar to alternatives B and C, alternative D has plan components, objectives, and management area designations that have the potential to improve riparian conditions. These include objectives for restoration treatments and riparian areas. In addition, new management areas (such as 203,117 acres recommended wilderness areas) are proposed that have land management plan components that would limit mechanical vegetation treatments and other activities that can have negative effects from soil compaction and erosion.

In this alternative D, 95 percent of all mapped riparian areas are in management areas where mechanical vegetation treatments and prescribed fire could occur. In these areas, fire condition regimes are improved, leading to reduced possibilities of uncharacteristically intense fires that would have impacts to riparian areas such as loss of vegetation and reduced functioning to dissipate floods and provide ecosystems functions. Mechanized vegetation treatments in riparian management zones would be uncommon under this alternative and guidelines ensure that, if planned, these activities would benefit the riparian area in the long term, with a few exceptions such as road crossings.

Alternative D does address the identified needs for change for riparian areas. The objectives for mechanical vegetation treatments and fire are directed at areas where fire regimes are departed. As a result, the risk of fire that could cause widespread impacts to riparian areas by impacting the uplands or direct fire in the riparian area would be decreased. Riparian management zones provide for targeted treatments in these areas while protecting riparian values.

Indicator: Water Resource Improvement Activities

Restoration activities within this indicator include a variety of activities that have beneficial effects of restoring hydrologic and biological processes which in turn restore ecosystems services associated with riparian areas such as aquatic habitat, flood dissipation, wildlife corridors, and water availability.

Alternative A: Riparian Areas

The objective for watershed improvement projects is 0 to 1 projects a year, or 0 to 15 projects over the analysis period. These actions would lead to improved condition of riparian areas by allowing for vegetative growth and attribute that lead to proper functioning condition.

Alternative B: Riparian Areas

Alternative B does address the identified needs for change for riparian areas. The implementation of 15 to 30 watershed improvement projects over the life of the plan could improve riparian areas if they are selected for improvement. In addition, alternative B proposes an increased number of watershed improvement projects at 1 to 2 projects a year which adds up to 15 to 30 projects during the analysis period. This increase in proposed projects has the potential to improve the riparian condition in up to 30 riparian areas. These improvement projects would lead to improved condition of riparian areas by allowing for vegetative growth and attribute that lead to proper functioning condition.

Alternative C and D: Riparian Areas

The implementation of 30 to 75 watershed improvement projects over the life of the plan could improve riparian areas if they are selected for improvement. These projects could lead to improvements in riparian areas by protecting vegetation through fencing, gully stabilization, or other practices that improve proper functioning condition and allow for riparian growth. This increase in proposed projects has the potential to improve the riparian condition in up to 75 riparian areas across the plan area.

Indicator: Livestock Management

Livestock management activities within this indicator include range improvement activities and strategies to improve range condition.

Alternative A: Riparian Areas

The focus for range is to administer the range program and ensure proper stocking levels. The standards and guidelines that pertain to riparian areas and range use are unclear in the 1985 plan. In addition, there are no guidelines for water developments related to livestock use, which often has left riparian areas without the water needed to sustain vegetation as described in the assessment report.

Ninety-eight percent of riparian areas in the plan area would be located where livestock is permitted in alternative A. In these areas, due to the complexity and extent of riparian areas in the plan area, there would be effects to a proportion of riparian areas from the loss of riparian vegetation and age classes, loss of vigor, and ground cover. As a result, proper functioning condition and support of higher ecological functions may not be supported.

In addition, objectives for the range program includes 5 to 10 range improvements which could include fencing and water development improvements that would allow for water flows for riparian areas.

Alternative B: Riparian Areas

Livestock use would be managed through an adaptive strategy, leading to improvements in how riparian areas are recognized and managed. In addition, objectives for the range program includes 15 to 20 range improvements which could include fencing and water development improvements that would allow water flows for riparian areas. These improvement projects could lead to improved condition of riparian areas by allowing for vegetative growth and attributes that lead to proper functioning condition. The implementation of 15 to 30 watershed improvement projects and 15 to 20 range improvement projects over the life of the plan could improve riparian areas if they are selected for improvement.

Ninety-three percent of riparian areas in the plan area are located in management areas where livestock is permitted in alternative B. Plan components for the range program have been improved. These plan components cover a broader range of potential effects from livestock use that what is found in alternative A. These include incorporating adaptive management, sustainable water developments, and guidelines to directly protect riparian areas. There are also more wildlife plan components which address conditions in riparian, especially for high-priority species. These proposed plan components will work to improve the management of riparian areas in the plan area, especially high-priority riparian areas that support important species or are unique. However, due to the complexity and extent of the riparian areas in the plan area, impacts such as reduced vigor in riparian plants, loss of age classes related to livestock use in riparian areas are likely to continue.

Alternative C: Riparian Areas

Ninety-five percent of riparian areas in the plan area are located in management areas where livestock is permitted in alternative C. Plan components for the range program have been improved. These plan components cover a broader range of potential effects from livestock use than that found in alternative A. These include incorporating adaptive management, sustainable water developments, and guidelines to directly protect riparian areas. There are also more wildlife plan components which address conditions in riparian, especially for high priority species. However, the focus in restoration areas will be watershed improvement projects. This could result in improvements, such as thinning and fencing, in up to 75 projects across almost 2,800 acres of riparian. In addition, objectives for the range program includes 225 to 300 range improvements which could include fencing and water developments that would allow water flows for riparian areas. These actions would lead to improved condition of riparian areas by allowing vegetative growth and attributes that lead to proper functioning condition. Due to the complexity and extent of the riparian areas in the plan area, impacts related to livestock use in riparian areas are likely to continue in some riparian areas.

Alternative D: Riparian Areas

Ninety-five percent of riparian areas in the plan area are located in management areas where livestock is permitted in alternative D. Plan components for the range program have been improved. These plan components cover a broader range of potential effects from livestock use than that found in alternative A. These include incorporating adaptive management, sustainable water developments, and guidelines to directly protect riparian areas. There are also more wildlife plan components which address conditions in riparian, especially for high-priority species. In addition, objectives for the range program includes 150 to 225 range improvements which could include fencing and water developments that would allow water flows and reduced impacts to for riparian areas. Due to the complexity and extent of the riparian areas in the plan area, impacts related to livestock use in riparian areas are likely to continue such as reduced vigor in riparian plants and loss of age classes.

Surface Water Resources

This section discusses the process used to assess potential effects to water resources such as streams and springs by the alternatives. The ecosystem characteristics of water resources include water quality and condition. Environmental consequences are not site specific in this programmatic assessment. The updated national hydrography dataset springs layer was used as a base layer. There are additional unmapped streams, including perennial and intermittent and springs located in the plan area. The alternatives are analyzed within a 15-year period since this is the same duration as the plan and effects could be evident from implementation within this time. The spatial extent are those water resources that are within the plan area since these are the features that could be affected by the proposed alternatives.

Potential effects to water resources from the proposed plan alternatives are discussed using proposed objectives for restoration, watershed improvement projects, and road decommissioning. In addition, overall plan components such as designation of management areas, standards and guidelines, and management approaches are also considered in terms of effects to water resources by alternative.

Indicator: Restoration Treatments

Vegetation management and prescribed fire as proposed in the alternatives for the land management plan are a good indicator for effects to water resources since it can have long-term and short-term effects, positive and negative. These activities include mechanical vegetation treatments and prescribed fire. In upland areas, much of this type of vegetation management would be guided by standards and guidelines as well as management approaches based on the Rocky Mountain Research Station General Technical Report 310 (Reynolds et al. 2013). While these practices are suitable for upland forest conditions, they are generally not suitable for water resource features such as streams, riparian areas, wetlands, and springs. The positive benefit of this type of upland treatments are improved watershed condition and reduced wildfire intensities. Negative effects include reduced stability, increased runoff, erosion, loss of shade, impacts to woody material and recruitment, and compaction. While positive effects occur across the landscape, negative effects are more site specific and reduced through the use of standards and guidelines that are proposed in the land management plan. Vegetation treatments for water resources such as streams, springs, and riparian areas are specifically designed to improve these features and varies by feature. These types of treatment would improve the proper functioning condition of these features by increasing diversity, improving structure, and maintaining habitats.

Effects Common to All Alternatives

Watershed improvement projects have beneficial effects that restore the hydrologic attributes of water resources. These projects could include stream stabilization, riparian plantings, spring restoration, ecologically friendly water developments, and road decommissioning. Improved water quality and flows are some of the effects expected from these activities.

Road decommissioning is a common restoration practice which removes the effects of the road prism by restoring drainage patterns and reducing compaction, runoff, and sedimentation. This benefits water resources by preventing concentrated runoff, increasing filtration, reducing hydrologic connectivity, and improving water quality. Short-term impacts are expect to occur during these activities when locations are near water resources features. Roads can deliver sediment to surface water resources because of compacted surface and disturbed soil (USDA Forest Service 2001).

Alternative A: Surface Water

Alternative A does not address the need for change identified in the land management plan process for surface water resources. There was a need for improved plan components to reach desired conditions for water resources, but alternative A largely reiterates the 1985 plan, as amended. The use of best management practices, including the designation of stream courses during timber sales and undefined controls on skidding are standards. These plan components are unclear and do not ensure protections for surface waters. There are objectives for watershed improvement projects, up to 15 projects over the analysis period. Road decommission objectives of up to fifteen miles are also included. There are objectives for vegetation treatments (up to 5,000 acres) and fire (prescribed and managed wildfire up to 15,000 acres). While these objectives would improve surface water resources by reducing impacts and improving the fire condition regime, the overall strategy of getting this work done would not be focused and may not benefit areas where improvement is needed.

Alternative A emphasizes mechanical timber sales and wildfire suppression. This focus does not recognize the need for change identified for restoration of fire condition regimes and the benefit of managed wildfire. Fire conditions under this alternative are likely to remain departed across a greater number of acres than under the alternatives which include the use of managed fire. As a result, this alternative is more likely to result in high-intensity wildfires that impact surface water resources resulting in flooding, water quality impacts, changes to the geomorphology of water resources, and instability. There are also objectives for fire and fuels treatments in areas where the vegetation is departed from reference conditions; the effectiveness for reducing the risk of uncharacteristic wildfire under this alternative would be less than alternative C

Alternative B: Surface Water

Mechanical vegetation treatments and prescribed fire and the use of managed wildfire are proposed to restore departed fire regime conditions. In management areas where mechanical vegetation treatments and prescribed are allowed, as much as 90 percent of mapped perennial streams, 87 percent of intermittent streams, and 95 percent of ephemeral streams are within areas where these treatments are possible. Seventy nine percent of mapped springs are within these areas. By being located in areas where restoration treatments are possible, these features could be protected from the effects related to departed fire condition such as uncharacteristic wildfire. Short-term effects are likely but would be minimized through the use of improved land management plan components.

Alternative B does address the need for change to improve water resource features. Plan components provide direction, guidelines, and management approaches to maintain and improve the condition of these feature to maintain stability and water quality. The objectives for mechanical vegetation treatments and fire are directed at areas where fire regimes are departed and could occur across the plan area. However, because vegetation treatments could occur across a broad area, the effect of these treatments may be less effective than proposed in alternative C where there is a landscape focus.

Alternative C: Surface Water

Alternative C proposes to treat with prescribed fire over the next 15 years. This would be done with the improved forest management direction that would promote improved fire regimes as described in the "Fire and Fuels" section. Ninety percent of mapped perennial streams, 87 percent of intermittent streams, and 95 percent of ephemeral streams are within areas where these treatments are possible.

Seventy nine percent of mapped springs are within these areas. But within the restoration areas, fewer water resource features are located: 35 percent of mapped perennial streams, 32 percent of intermittent streams, 14 percent of ephemeral streams, and 16 percent of springs. By being located in areas where restoration treatments are possible, these features could be more effectively protected from the effects related to departed fire condition such as uncharacteristic wildfire. Short-term effects are likely but would be minimized through the use of improved land management plan components. In these areas, fire condition regimes are improved, leading to reduced possibilities of uncharacteristically intense fires that would have impacts to water resources such as increased flood flows, instability, and reduced functioning to dissipate floods and provide ecosystems functions.

Alternative C does address the identified needs for change for water resource features through improved standards and guidelines, the designation of restoration management areas, and increased objectives for restoration activities. The objectives for mechanical vegetation treatments and prescribed fire are the highest in this alternative and focused in areas where fire regimes are departed. As a result, the risk of fire that could cause widespread impacts to water resources in these areas would be decreased. By increasing the magnitude of objectives and focusing in designated restoration management areas, this alternative has the greatest potential to improve and protect surface water resource features.

Alternative D: Surface Water

Mechanical vegetation treatments and prescribed fire and the use of managed wildfire are proposed to restore departed fire regime conditions. Similar to alternative B, 90 percent of mapped perennial streams, 87 percent of intermittent streams, and 95 percent of ephemeral streams are within areas where these treatments are possible. Seventy nine percent of mapped springs are within these areas. By being located in areas where restoration treatments are possible, these features could be protected from the effects related to departed fire condition such as uncharacteristic wildfire. Short-term effects are likely but would be minimized through the use of improved land management plan components.

Alternative D does address the need for change to improve water resource features. Plan components provide direction, guidelines, and management approaches to maintain and improve the condition of these feature to maintain stability and water quality. The objectives for mechanical vegetation treatments and fire are directed at areas where fire regimes are departed and could occur across the plan area. Riparian management zones provide for targeted treatments in these areas while protecting the values associated with water resource features such as clean water and stable streams. However, because vegetation treatments could occur across a broad area, the effect of these treatments may be less effective than proposed in alternative C where there is a landscape focus.

Mechanical vegetation treatments and prescribed fire and the use of managed wildfire are proposed to restore departed fire regime conditions which could lead to long term positive effects for water resources. While the mechanized vegetation treatments are in management areas where mechanical vegetation treatments and prescribed are allowed, as much as 90 percent of mapped perennial streams, 87 percent of intermittent streams, and 95 percent of ephemeral streams are within areas where these treatments are possible. Seventy nine percent of mapped springs are within these areas. By being located in areas where restoration treatments are possible, these features could be protected from the effects related to departed fire condition such as uncharacteristic wildfire. Short-term effects are likely but would be minimized through the use of improved land management plan components. Because these treatments could occur across the plan area, the effectiveness is decreased which leads to less impact to improvement in water resource feature when compared to alternative C.

Indicator: Water Resource Improvement Activities

Restoration activities within this indicator include a variety of activities that have beneficial effects of restoring hydrologic and biological processes which in turn restore ecosystems services associated with surface water resources.

Effects Common to Alternatives B, C, and D: Surface Water

Plan components directed at water resource features are the same for alternatives B, C, and D. These include the establishment of a riparian management zone of at least 100 feet unless site-specific conditions determine other effective widths. Riparian management zones include perennial and intermittent streams. Management activities in these zones should not degrade the attributes and promote the desired condition. Plan components ensure management practices do not cause detrimental changes in water temperature, chemical composition, and sediment deposits that seriously affect water conditions or habitat. In addition, there are guidelines to protect the hydrologic flows that sustain surface water flows and dependent resources. By including these components, there is a more comprehensive approach to protecting, maintaining, and restoring water resource features.

The emphasis is to restore landscape conditions through vegetation treatments using mechanized methods and fire to reduce the density of trees in the uplands. Fire is also an important tool in these alternatives with emphasis placed on the use of both prescribed and managed wildfire to improve fire condition regimes.

Alternative A: Surface Water

Alternative A proposed the least amount of road decommissioning among all of the proposed alternatives. Up to 15 miles of roads could be decommissioned leading to reduced concentrated runoff and hydrologic connectivity across watersheds that drain into surface waters. While these activities have short-term effects, the long-term effects would reduce the density and distribution of roads, thereby moving the hydrologic regime of surface waters closer to the proper functioning levels where road density is less than 1 mile per square mile and less than 10 percent of the roads are located within 300 feet of a water resource (USDA Forest Service 2011c). Fifteen miles of road decommissioning are unlikely to have major impacts to these numbers but would work to move conditions in the right direction, especially in localized areas.

Alternative A does not include the use of riparian management zones which have the extra benefit of protecting the surface water resources with which they are associated. While buffers are mentioned in the plan components in alternative A, it is not clear what activities are allowed in these areas or how to implement them. Buffers are recognized as one of the most effective ways to filter water and sediment, reduce chemical input such as herbicides, and protect features from concentrated runoff (Belt et al. 1992; Clinton 2011; Lee et al. 2004). Because of this, water resources features would be protected less in this alternative because they would not have the benefit of riparian management zones applied to all perennial and intermittent streams for all activities.

Alternative B: Surface Water

Alternative B addresses the need for change to improve water resources condition by including plan components, objectives and management areas designation that would work to improve water resource conditions across the plan area. There are objectives for watershed improvement projects, 15 to 30 projects over the analysis period. Road decommission objectives of 15 to 45 miles are also included.

Improved road guidelines and objectives for decommissioning (15 to 45 miles) could have a moderate impact on the effects of roads on water resource features by reducing road densities and miles of road within 300 feet of a water resource feature thereby reducing road runoff, sedimentation, and hydrologic connectivity across the watersheds that drain into surface waters. This effect is dependent on location of roads selected for decommissioning.

Since most roads in the plan area are located within 300 feet of a water resource feature, plan components that address road conditions are important. As in alternatives C and D, there are guidelines that address the issue of impacts to water resource features. These include several practices directed at stream crossings that minimize, reduce, and ensure proper design at these locations. Areas where roads cross streams are persistent sources of sediment and erosion, leading to water quality and stability concerns. By improving the management of these areas, sediment and erosion will be reduced, thereby improving the condition of these resources.

While these activities have short-term effects, the long-term effects would reduce the density and distribution of roads, thereby moving the hydrologic regime of surface waters closer to the proper functioning levels where road density is less than 1 mile per square mile and less than 10 percent of the roads are located within 300 feet of a water resource (USDA Forest Service 2011c).

Alternative C: Surface Water

Alternative C has improved land management plan components similar to alternatives B and D that are directed at the need for change for water resources. Alternative C proposes a management area with a restoration focus and this is where the mechanical vegetation treatments, prescribed fires, and watershed improvement projects would largely be implemented. This results in more effective restoration work because projects can occur in smaller areas and targeted at high-priority areas. In addition, alternative C has objectives of 30 to 75 watershed improvement projects and 45 to 75 miles of road decommissioning. This increase in objectives has the potential to improve hydrologic conditions that currently impact water resource features by reducing high fire severity associated with wildfires, decreasing increased runoff and flooding from roads, and improving the resiliency of water resource features.

As in alternatives B and D, there are guidelines that address the issue of impacts to water resource features. Between 45 to 75 miles of road decommissioning would lead to effects of reduced concentrated runoff and hydrologic connectivity across the watersheds that drain into surface waters. While these activities have short-term effects, the long-term effects would reduce the density and distribution of roads, thereby moving the hydrologic regime of surface waters closer to the proper functioning levels where road density is less than 1 mile per square mile and less than 10 percent of the roads are located within 300 feet of a water resource (USDA Forest Service 2011c).

Alternative D: Surface Water

Alternative D addresses the need for change to improve water resources condition by including plan components, objectives and management areas designation that would work to improve water resource conditions across the plan area. There are objectives for watershed improvement projects, 30 to 75 projects over the analysis period. Road decommission objectives of 45 to 75 miles are also included.

Forty-five to 75 miles of road could be decommissioned, leading to reduced concentrated runoff and hydrologic connectivity across the watersheds that drain into surface waters. While these activities have short-term effects, the long-term effects would reduce the density and distribution of roads, thereby moving the hydrologic regime of surface waters closer to the proper functioning levels where road density is less than 1 mile per square mile and less than 10 percent of the roads are located within 300 feet of a water resource (USDA Forest Service 2011c).

Watershed Condition

The timeline is 15 years, the life of the plan since this is the timeframe that the proposed activities could occur. In addition, fifteen years is not enough time for the fire condition class to worsen, based on fire return intervals and vegetation characteristics. The extent are the National Forest System lands within the rated 12-digit hydrologic unit code subwatersheds that intersect the plan area. This scale was selected because this the scale watersheds are rated for watershed condition using the Watershed Condition Framework (Potyondy and Geier 2011).

Indicator: Restoration Treatments

Alternative A: Watershed Condition

Alternative A proposes to treat 75,000 acres with mechanical vegetation treatments, 150,000 acres with prescribed fire, and 75,000 acres of managed wildfire over the next fifteen years. This would be done with the same forest management direction found in the 1985 plan, as amended. This means the emphasis is on timber harvest and wildfire suppression. Therefore the use of managed wildfire, an important tool to restore fire condition class (fire regime condition class), is limited. Alternative A includes some elements for inventorying and analyzing watersheds and standards and guidelines for improving water resources, but current issues such as watershed restoration are not addressed.

Plan objectives in alternative A include mechanical vegetation treatments, prescribed fire, and managed wildfire which could improve the fire condition class rating (fire regime condition class) and thereby improve watershed conditions. Under this alternative, fire management issues and condition are expected to continue much as they have in the past. Proposed vegetation and fire activities would reduce the number of acres susceptible to adverse fire effects such as soil erosion, sedimentation, and flooding which lead to decreased watershed conditions. However, while vegetation treatments and prescribed fire are allowed on much of the plan area outside of wilderness under this alternative, managed wildfire is largely limited to wilderness areas. Suppression of wildfire is the goal in most of the other management areas. Because of this, watershed condition related to the fire condition class will improve the least under this alternative due to the limited scope and ability of fire management to address the departure in fire conditions across watersheds in the plan area. The benefits to watershed condition from the restoration activities are least likely under this alternative since changes in fire regime condition class would occur in more limited locations, often where the need is not greatest.

Effects Common to Alternatives B, C, and D: Watershed Condition

Alternatives B, C, and D include direction that would allow management-ignited prescribed fire and managed natural fire across most of the plan area. In addition, there is guidance for the type of mechanical vegetation treatments that would improve the fire regime and therefore watershed condition by lowering the risk for high severity wildfire.

Alternatives B, C, and D include specific direction for mechanical vegetation treatments that would reduce the fire regime condition class rating in those treated acres.

Alternative B: Watershed Condition

Alternative B proposes to treat 75,000 acres with mechanical vegetation treatments, 180,000 acres with prescribed fire, and 82,500 acres of managed wildfire over the next 15 years. This would be done with the improved forest management direction that would promote improved fire regimes as described in the "Fire and Fuels" section. This means the emphasis is on activities that include managed wildfire, prescribed fire, and specific standards and guidelines for vegetation treatments that would reduce ladder fuels and improve surface conditions, leading to overall improved watershed condition.

Plan objectives in alternative B include improved mechanical vegetation prescriptions which lead to improved fire condition class rating (fire regime condition class) and thereby improved watershed conditions. In addition, prescribed fire and managed wildfire would have broader ecological applications across more acres, leading to improved fire conditions and watershed condition across the plan area. Proposed vegetation and fire activities would reduce the number of acres susceptible to adverse fire effects such as soil erosion, sedimentation, and flooding which lead to decreased watershed conditions. While the treatments would largely occur in ponderosa pine and mixed conifer treatments, these treatments would not have a focus as found in alternative C. Unlike alternative A, however, more treatment options to improve fire regime condition class would be available across a greater portion of the landscape, leading to improved watershed conditions by reducing the risk of a catastrophic wildfire. Improvement of watershed condition using these objectives combined with the improved standards and guidelines and management approaches, would ensure that over the long term, hydrologic processes would have improved function and resiliency, leading to watersheds that provide ecosystems services to support a healthy forest and growing populations.

Alternative C: Watershed Condition

Alternative C proposes to treat 105,000 acres with mechanical vegetation treatments, 210,000 acres with prescribed fire, and 90,000 acres of managed wildfire over the next 15 years. This would be done with the improved forest management direction that would promote improved fire regimes as described in the "Fire and Fuels" section. This means the emphasis is on restoration treatments that include managed wildfire and specific standards and guidelines for vegetation treatments that would reduce ladder fuels and improve surface conditions, leading to overall improved watershed condition. In addition, mechanical vegetation and prescribed fire treatments would be focused in key restoration management areas. Watersheds which intersect these areas would likely have improvements in the overall fire regime condition class ratings, which could lead to an improved watershed condition rating.

Plan objectives in alternative C include improved mechanical vegetation prescriptions which lead to improved fire condition class rating (fire regime condition class) and thereby improved watershed conditions. Proposed vegetation and fire activities would reduce the greatest number of acres susceptible to adverse fire effects such as soil erosion, sedimentation, and flooding which lead to decreased watershed conditions. While the treatments will largely occur in ponderosa pine and mixed conifer treatments, these treatments would have a focus in the restoration management areas. This would have the effect of improving the watershed condition in a smaller number of watersheds than alternatives A, B, and D despite the increase in treatment acres, but the improvement in those treated watersheds would be greater due to the focus. In these improved watersheds, ecosystem services such as public water supply and reduced flooding are protected more due to improved hydrologic functions, reduced risk of wildfire, and resiliency.

Alternative D: Watershed Condition

Similar to alternative B, alternative D proposes to treat 75,000 acres with mechanical vegetation treatments, 180,000 acres with prescribed fire, and 82,500 acres of managed wildfire over the next 15 years. This would be done with the improved forest management direction that would promote improved fire regimes as described in the "Fire and Fuels" section. This means the emphasis is on treatments that include prescribed and managed wildfire and specific standards and guidelines for vegetation treatments that would reduce ladder fuels and improve surface conditions, leading to overall improved watershed condition.

Plan objectives in alternative B include improved mechanical vegetation prescriptions which lead to improved fire condition class rating (fire regime condition class) and thereby improved watershed conditions. In addition, prescribed fire and managed wildfire will have broader ecological applications across more acres, leading to improved fire conditions and watershed condition across the plan area. Watershed condition would be improved by the implementation of the proposed vegetation and fire activities that reduce the number of acres susceptible to adverse fire effects such as soil erosion, sedimentation, and flooding. While the treatments will largely occur in ponderosa pine and mixed conifer treatments, these treatments would not have a focus as found in alternative C. Unlike alternative A, however, more treatment options to improve fire regime condition class would be available across a greater portion of the landscape, leading to improved watershed conditions by reducing the risk of a catastrophic wildfire. Improvement of watershed condition using these objectives, combined with the improved standards and guidelines and management approaches, would ensure that over the long term, hydrologic processes would have improved function and resiliency, leading to watersheds that provide ecosystems services to support a healthy forest and growing populations.

Summary of Watershed Condition

Due to the lack of direction on restoration activities and watershed conditions, alternative A provides the least potential for watershed improvement. Alternatives B, C, and D incorporate new and updated forest management direction, standards, and guidelines, management approaches to accomplish restoration work across a greater portion of the plan area. This would lead to improved watershed conditions across the plan area. Alternative C would focus mechanical vegetative and prescribed fire treatments in key areas, leading to watersheds with more treated acres. This could lead to an improvement in the condition class in these watersheds as determined by the Watershed Condition Framework (Potyondy and Geier 2011).

Cumulative Effects

Riparian Areas

The location and distribution of riparian areas in addition to the condition of riparian areas is dependent on natural factors such as climate, geology, and hydrology in addition to management actions within the plan area. The timeframe for assessing cumulative effects to riparian areas is 15 years since that is the life of the land management plan. The spatial boundary of the analysis is the extent of the two hundred and eight 12-digit subwatersheds that intersect the plan area that contains riparian areas. This is because within these subwatersheds, riparian areas are affected by upstream watershed processes.

The past, present, and future activities that could affect riparian areas on National Forest System lands in these watersheds include livestock grazing, prescribed and natural fire, wildfire suppression, recreation, mining, vegetation management, noxious week treatments, road construction and maintenance, road decommissioning, wildlife habitat restoration and management, water resource restoration, and water withdrawals. Outside the Cibola within these watersheds, similar activities could occur including urban, suburban, and rural communities, industrial businesses, and agriculture. Increasing drought, more extreme weather, and loss of snow pack also add to cumulative effects.

The cumulative effects of historic land uses, especially high livestock use combined with drought, have resulted in impacts to the extent and condition of riparian areas. Loss of riparian areas due to overgrazing from cows, sheep, and goat, gullying as the water table drops, and development has been documented across the Southwest, including in the plan area (Malanson 1993; USDA Forest Service 1998). Intensive grazing pressure results in loss of ground cover, loss of younger age classes in riparian areas, loss of vigor, and reduce stability of associated water resources such as streambanks. While this level of livestock use is no longer in practice, the effects from this time persist. Improved livestock management has led to the recovery of many riparian areas, while others have been lost due to loss of water and lack of vegetation. While management of riparian areas in and outside the plan area is improving due to improved proposed in the alternatives and statewide initiatives, climate factors are expected to greatly affect riparian areas, even within the next 15 years. Drought is likely in this period, leading to impacts from lack of water and increased wildfire activity. Increased water withdrawals, especially out of the plan area, are likely to impact riparian areas through loss of the water that sustains these systems.

Water Resources

The timeline for assessing cumulative effects to water resources is 15 years, the life of the plan since this is the timeframe that the proposed activities could occur. In addition, fifteen years is enough time for the effects of the new plan components on water resources to become evident. The extent are the water resource features within the 12-digit hydrologic unit sub-watersheds that intersect the plan area.

The past, present, and future activities that could affect water resources on National Forest System lands in these watersheds includes livestock grazing, prescribed and natural fire, wildfire suppression, recreation, mining, vegetation management, noxious week treatments, road construction and maintenance, road decommissioning, wildlife habitat restoration and management, water resource restoration, and water withdrawals. Outside the Cibola within these watersheds, similar activities could occur including urban, suburban, and rural communities, industrial businesses, and agriculture.

Many of the same impacts that have occurred to riparian areas are the same as those that have impacted water resources. The cumulative effects of historic land uses, especially high livestock use combined with drought, have resulted in impacts to the condition of water resource features. Loss of ground cover, increase erosion, down-cutting of stream channels, overuse of springs due to overgrazing from cows, sheep, and goats have resulted in gullies, lowered water table, and instability. These effects have been documented across the Southwest, including in the plan area (Malanson 1993; USDA Forest Service 1998). While this level of livestock use is no longer practices, the effects from this time persist. Improved livestock management and regulation such as the Clean Water Act have led to the recovery of many water resources while others have been lost due to loss of water and channelization.

While management of water resources both on and outside of the plan area is improving due to improvements proposed in the alternatives and national and state regulations and initiatives, climate factors are expected to greatly affect water resources, even within the next 15 years. Drought is likely in this period, leading to impacts from lack of water and increased wildfire activity. Increased water withdrawals and loss of recharge from diminished snowpacks are likely to impact streams and springs through loss of the water that sustains these systems. The increase in extreme weather events will also have an impact, leading to increased flood flows that will change the morphology of streams and change recharge patterns.

Watershed Condition

The timeline for assessing cumulative effects to watershed resources is 15 years, the life of the plan since this is the timeframe that the proposed activities could occur. The analysis area is the two hundred and eight 12-digit hydrologic unit code sub-watersheds that intersect the plan area. This scale was selected because this is the scale at which watersheds are rated for watershed condition using the Watershed Condition Framework (Potyondy and Geier 2011).

The past, present, and future activities that could affect water resources on National Forest System lands in these watersheds includes livestock grazing, prescribed and natural fire, wildfire suppression, recreation, mining, vegetation management, noxious week treatments, road construction and maintenance, road decommissioning, wildlife habitat restoration and management, water resource restoration, and water withdrawals. Outside the national forest within these watersheds, similar activities could occur including urban, suburban, and rural communities, industrial businesses, and agriculture.

Many of the 12 indicators in the Watershed Condition Framework (Potyondy and Geier 2011) were impacted in the past by livestock grazing, mining, vegetation management, roads, water withdrawals, and agriculture. The function of watersheds were reduced during the mid to late 1800s during a period of overgrazing by cattle and sheep (USDA Forest Service 1998). Aquatic physical and biological parameters such as water quality, water quantity, aquatic habitat and biota, and riparian wetland vegetation were impacted. Livestock grazing that coincided with drought resulted in lowering of the water table as gullies developed and riparian areas were diminished or lost. This effect is still evident across the plan area by the presence of gullies, remnant riparian areas, and lack of ground cover. Roads and developed surfaces associated with recreational sites and trails added to this impact by concentrating runoff and causing erosion and gullies. Water quantity in streams and at springs was decreased by consumptive uses for agriculture and drinking water. In addition, terrestrial physical and biological components such as soil condition and fire regime were also impacted. As ground cover decreased, soil conditions also declined, resulting in less productivity and effects to infiltration of water. Past practices of vegetation and fire management contributed to increased risk of catastrophic fire from overly dense forest lands, leading to impaired soils, high erosion rates, and flooding. Mining during this time usually occurred without consideration of impacts, resulting in areas with polluted soil and water. Many of these activities occurred prior to the establishment of the National Forest System lands and were prevalent across the analysis area.

Many of these same activities are occurring today but are managed to minimize effects and restore areas with impacts. Improved forest management, including the implementation of best management practices, is used in the plan area. Best management practices apply to all activities within the plan area and mitigate effects from livestock grazing, mining, vegetation management, roads, recreation, and water withdrawals. In this way, aquatic and terrestrial effects are reduced and reversed where possible. Mining activities also use best management practices to reduce effects and restoration plans are in place prior to mining activities and implemented afterwards. Many old mining sites are cleaned up, resulting in improved soil and water conditions in these areas. In addition, vegetation and fire management are focused on restoring fire regimes and reducing density of the forest to reduce the risk of watershed impacts from catastrophic fire. Travel management has been implemented across the plan area. This has resulted in a reduced road system where roads that impact water resources are identified and improved. Within the analysis area, but outside National Forest System lands, all these activities have also improved as New Mexico has implemented regulations to manage many of these activities. This has resulted in improvements to water and soil resources outside of the plan area as well, leading to improvements in overall watershed condition. Urban, suburban, and rural developments have localized impacts which are often downstream of the plan area. Communities often have higher amounts of roads, water withdrawals, and impervious surfaces such as pavement with the intensity increasing with housing. Similar to other activities outside of the National Forest System lands, regulations and guidelines by state, county, and municipal entities reduce these impacts through the use of best management practices and permitting. Despite this, the inevitable impacts of developed areas leads to decreases in watershed condition by changing water quality and quantities, aquatic habitats, and soil productivity.

In future, watershed condition and the indicators used to determine it will continue to be affected. Within the plan area, improved management using the proposed plan would work to improve conditions especially the fire regime. Vegetation and fire management activities will be focused on improving the fire regime by thinning, reducing the potential for crown fire, severe erosion, and increased flooding. The combined issues of population growth and climate variability will add to effects by increasing risk and uncertainty with the magnitude of changes associated with these effects. Population growth and climate variability will impact the analysis area across all ownerships. Population increases could lead to continued use and need for roads and recreational opportunities. This would increase the extent of effects caused by these activities thereby impacting several of the indicators used to determine watershed condition. Climate variability is likely increase conditions conducive to wildfire and drought. This will increase effects to aquatic and terrestrial resources such as soil, water, and habitat. Most springs are dependent on snowpack which is expected to decrease in the future. This would dry up springs, resulting in a lack of water across the landscape, impacting both livestock and wildlife. Continued implementation of travel management will work towards reducing the impacts associated with roads. Activities outside of the plan area are likely to occur in the much the same way as currently. Regulations will work to reduce effects related to developments, roads, and agriculture on these lands.

Soils

Background

Soils are intricately linked to climate, vegetation, and geology. Soils tend to be shallow and rocky on steep, unstable slopes, whereas moderately steep to flat slopes tend to have deeper, more developed soils. The Cibola occurs on scattered isolated mountain ranges that exhibit a variety of bedrock material and mountain-forming processes. Across the Cibola, soils vary from an aridic (dry) moisture regime and thermic (very warm) temperature regime at lower elevations to an udic (humid–subhumid) moisture regime and cryic (very cold winter, cold summer) temperature regime at the highest elevations.[16]

Measures

Soil erosion hazard and soil condition are measures of, and directly linked to, the ability of the soil to withstand disturbances from management activities and natural events while maintaining site productivity and sustainability. These characteristics are used to analyze the reference and current conditions and future trends of the soil resource. The soil erosion hazard rating reflects inherent site and soil characteristics. Soil condition rates soils as they exist currently and reflects the effects of management and disturbance history on soil quality—soils were generally assumed to be in satisfactory soil condition under reference conditions.

Soil Erosion Hazard

Soil erosion hazard is the probability of soil loss resulting from complete removal of vegetation and litter—an *inherent* soil property (not influenced by management). Slope, soil texture, and vegetation type greatly influence soil erosion hazard rating. It is an interpretation based on the relationship between the maximum soil loss and the tolerable (threshold) soil loss of a site.

Soil Erosion Hazard Categories

Soils are given a slight, moderate, or severe erosion hazard rating:

- **slight** - loss in soil production potential from erosion is low.
- **moderate** - loss in soil production from erosion is probable and significant if left unchecked.
- **severe** - loss in soil production from erosion is inevitable and irreversible if unchecked.

These ratings provide land managers with an index for identifying three classes of land stability and are useful in determining areas with the greatest potential for response to seeding after wildfire or areas that should receive minimum exposure of mineral soil. Soil erosion hazard was calculated using the Hillslope Erosion Model (Lane et al. 1995) for all major soils within the vegetation types.

Soil Condition

Soil condition is an evaluation of soil quality based on an interpretation of factors which affect vital soil functions. Soil quality is the capacity of the soil to function within ecosystem boundaries to sustain biological productivity, maintain environmental quality, and promote plant and animal health (Doran and Parkin 1994).

[16] For a complete explanation of soil temperature and moisture regimes, see Keys to Soil Taxonomy, 11th ed. (Soil Survey Staff 2010).

The interrelated functions of soil hydrology, soil stability, and nutrient cycling are evaluated to assess soil condition. Unlike soil erosion hazard, soil condition is influenced by management.

- **Soil Hydrology**. This function is assessed by evaluating or observing changes in surface structure, surface pore space, consistence, bulk density, infiltration, or penetration resistance using appropriate methods. Increases in bulk density or decreases in porosity result in reduced water infiltration, permeability, and plant-available moisture.
- **Soil Stability**. Erosion is the detachment, transport, and deposition of soil particles by water, wind, or gravity. Vascular plants, soil biotic crusts, and litter cover are the greatest deterrents to surface soil erosion. Visual evidence of surface erosion may include rills, gullies, pedestalling, soil deposition, erosion pavement, or loss of the "A" (surface) horizon. Erosion models are also used to predict on-site soil loss.
- **Nutrient Cycling**. This function is assessed by evaluating plant community composition, litter, coarse woody material, root distribution, and soil biotic crusts. These indicators are directly related to soil organic matter, which is essential in sustaining long-term soil productivity. Soil organic matter provides a carbon and energy source for soil microbes and provides nutrients needed for plant growth. Soil organic matter also provides nutrient storage and capacity for cation and anion exchange.

Soil Condition Categories

Vegetation types are assigned a soil condition category which is an indication of the status of soil functions. Soil condition categories reflect soil disturbances resulting from both planned and unplanned events. Current management activities provide opportunities to maintain or improve soil functions that are critical in sustaining soil productivity. The following is a brief description of each soil condition category:

- **Satisfactory.** Indicators signify soil function is being sustained and soil is functioning properly and normally. The ability of soil to maintain resource values and sustain outputs is high.
- **Impaired.** Indicators signify a reduction of soil function. The ability of soil to function properly has been reduced or there exists an increased vulnerability to degradation. An "impaired" rating should signal to land managers a need to further investigate the ecosystem to determine causes and degrees of decline in soil functions. Changes in management practices or other preventative actions may be appropriate.
- **Unsatisfactory.** Indicators signify loss of soil function has occurred. Degradation of vital soil functions results in the inability of soil to maintain resource values, sustain outputs, and recover from impacts. Soils with an "unsatisfactory" rating are candidates for improved management practices or restoration designed to recover soil functions.

Future management activities need to be evaluated to determine if the current management activity is contributing to the loss of soil function. In some cases, current management activities may not have caused the loss of soil function but may be preventing recovery. Future management activities that slow or prevent recovery of soil function should be avoided.

Affected Environment

Reference Condition,[17] Current Condition, and Trend

Erosion Hazard

The magnitude of natural disturbances under reference conditions was smaller than under current conditions, and the subsequent loss of vegetation and litter for a given site—and the likelihood of erosion—would have been smaller as well. However, it is probable when soils with high erosion hazard were burned and farmed, accelerated erosion occurred after storms.

The range in erosion hazard classes within a vegetation type often reflect the various slope gradients, landforms, and associated thresholds on which they occur.

The "severe" erosion hazard class includes vegetation types occurring primarily on steep landforms (mountain slopes, escarpments, hills) such as Wet Mixed Conifer, PJ Woodland, and PJ Evergreen Shrub (figure 3). Where these systems occur within watersheds with excessive fuel loadings and uncharacteristic disturbance regimes, there is a high potential risk for accelerated erosion exceeding thresholds and subsequent runoff.

Conversely, the majority of sites with predominately slight erosion hazard ratings occur on moderately sloping to nearly level landforms including piedmont plains, alluvial fans, valley plains, stream terraces, and floodplains and support the Chihuahuan Desert Scrub, Chihuahuan Salt Desert Scrub, Intermountain Salt Scrub, Sagebrush Shrubland, and Sandsage vegetation types. Although these vegetation types have low erosion hazard potentials, soil loss from lack of vegetative ground cover is contributing to unsatisfactory and impaired soil conditions.

Sites that predominantly have moderate erosion hazard on moderately sloping landforms support the Dry Mixed Conifer, Mountain Mahogany Mixed Shrubland, Madrean Pinyon-Oak Woodland, Montane/Subalpine Grassland, and Spruce-Fir vegetation types.

Soil Condition

Satisfactory soil condition (soil quality) is important in maintaining long-term soil productivity—key to sustaining ecological diversity. Unsatisfactory and impaired soil conditions have resulted in the reduced ability of the soil to grow plants and sustain productive, diverse vegetation.

Very little quantitative data exist to measure historical soil condition. However, some qualitative and quantitative inferences can be made, providing insight into historical soil condition by using knowledge about present disturbances and their effect on soil stability, soil compaction, and nutrient cycling. Reference conditions generally estimate pre-European settlement conditions.

Historically (without human-caused disturbance), soil loss, soil compaction, and nutrient cycling would probably have been within functional limits to sustain soil function and maintain soil productivity for most soils that are not inherently unstable—the exception being during cyclic periods of drought and possibly local areas impacted through nondomestic herbivory. Natural flood disturbance would have had a limited effect on the extent of soil loss, only causing accelerated erosion adjacent to stream channels or floodplains. Drought may have reduced the amount of protective vegetative ground cover resulting in accelerated erosion during prolonged rainstorms.

[17] Desired conditions for soils do not vary by alternative and may be considered synonymous with reference conditions.

The most productive soils (satisfactory soil condition) historically and currently are within the Gambel Oak Shrubland, Wet Mixed Conifer, Dry Mixed Conifer, and Spruce-Fir vegetation types (figure 3). These vegetation types produce high amounts of organic matter to ensure stability of the soil and support nutrient cycling.

Other vegetation types that historically were very productive and assumed to have satisfactory soil condition but are now impaired through a reduction in soil function include the Montane/Subalpine Grassland, Colorado Plateau/Great Basin Grassland, Chihuahuan Desert Scrub, Chihuahuan Salt Desert Scrub, Intermountain Salt Scrub, Mountain Mahogany Mixed Shrubland, PJ Grass, Ponderosa Pine Forest, Sandsage, and Sagebrush Shrubland. The lack of effective vegetative ground cover and organic matter has resulted in unstable soils with reduced nutrient cycling in these vegetation types. The Montane/Subalpine Grassland is most vulnerable to soil condition decline. It is the only Cibola grassland with (1) a tree-invaded seral state (28 percent versus none in reference condition), (2) the most highly departed understory (48 percent), (3) the most highly departed fire regime (95 percent is moderately or highly departed) (USDA Forest Service 2015a), and (4) a current soil condition that is more than half impaired or unsatisfactory combined with a mostly moderate or severe soil erosion hazard (figure 3).

The PJ Evergreen Shrub and PJ Woodland vegetation types are at least 40 percent unsatisfactory; however, all other vegetation types are predominately satisfactory or impaired (figure 3). Additionally, some soils are considered inherently unstable. Inherently unstable soils are those in which their geologic formation and geomorphic properties are naturally active, and soil erosion has existed historically and will continue. Inherently unstable soils are dispersed across the landscape and occur primarily in the PJ vegetation types. Soil erosion hazard influences soil condition—an inherently unstable soil is more vulnerable to soil condition impairment than an inherently stable soil.

Current estimates of soil trend are not available; however, stressors such as altered fire regimes, nonnative species, and drought—coupled with historical unmanaged grazing and fuelwood gathering—have produced unnaturally dense overstories and sparse vegetative ground cover. Soil erosion may be occurring beyond its threshold due to high amounts of bare soil and larger, more intense wildfires; and many soils may be trending toward conditions of accelerated erosion and declining site productivity. Current management practices strive to restore ecosystem health and improve soil condition as budgets allow.

Risk Assessment

While soil erosion hazard is an inherent soil property and not influenced by management, soil condition is influenced by management and is the sole criterion used in this risk assessment. Most of the Cibola vegetation types are considered to be at moderate risk for soil condition (at least 25 percent impaired); the PJ Evergreen Shrub and PJ Woodland vegetation types are at least 25 percent unsatisfactory and considered to be at high risk (figure 3).

Assessment of Current Risk

While soil erosion hazard is an inherent soil property and not influenced by management, soil condition is influenced by management and is the sole criterion used in this assessment of current risk. Most of the Cibola vegetation types are considered to be at moderate risk for soil condition (at least 25 percent impaired); the PJ Evergreen Shrub and PJ Woodland vegetation types are considered to be at high risk (at least 25 percent unsatisfactory) (figure 3). Future projects should address the site-specific characteristics (plant basal cover, canopy cover, litter, coarse woody material, etc.) that are in need of improvement.

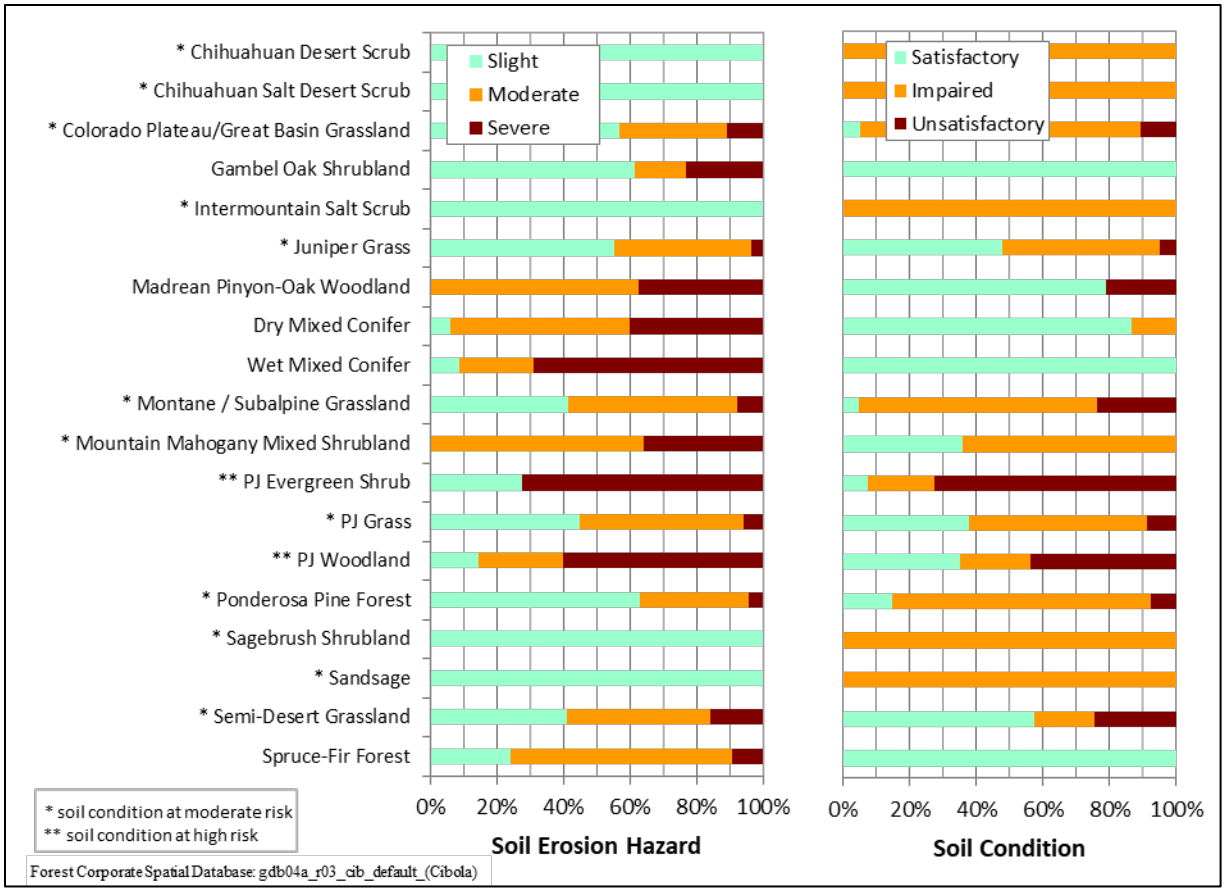


Figure 3. Soil erosion hazard (left) and current soil condition (right) of Cibola vegetation types.

Environmental Consequences

Indicators of Soil Condition[18]

Soil condition is an evaluation of soil quality based on an interpretation of factors which affect three primary soil functions: soil hydrology, soil stability, and nutrient cycling. The following indicators are used to in this analysis the compare the effects of the different alternatives on soil condition.

- **Function: soil hydrology**
  - **Indicator: Infiltration.** Soil water is necessary for plant growth. The rate at which water infiltrates the soil is influenced by inherent site properties like soil texture and slope and by other factors like fire and compaction. If fire burns long enough and hot enough, it may alter the surface chemistry of the soil, making it more hydrophobic (water repelling) which can reduce water infiltration and increase surface runoff and erosion. Compaction (foot traffic, vehicles, etc.) decreases pore space in the soil, also reducing water infiltration and increasing surface runoff. Vegetation and litter slow overland flow of water, allowing more time for water to enter the soil.

[18] Adapted from Technical Guidance for Soil Quality Monitoring in the Southwestern Region (USDA Forest Service 2013c).

- **Function: soil stability**
  - **Indicator: Plant cover, litter, and soil biotic crusts.** Vascular plants, soil biotic crusts, and litter cover are the best deterrents to surface soil erosion. Herbaceous vegetation produces many, fine roots underground and readily decomposable litter aboveground—key ingredients to maintaining good soil stability.
- **Function: nutrient cycling**
  - **Indicators: Litter and coarse woody material.** These indicators are directly related to soil organic matter, which is essential in sustaining long-term soil productivity, desirable soil texture, and soil water-holding capacity. Soil organic matter provides a carbon and energy source for soil microbes and provides nutrients needed for plant growth.

Assumptions

- Best management practices are followed, and soil condition improves as a result of all management activities in the long term, although there may be some temporary impairment in the short-term. For example, soil may be disturbed when an overstocked stand of timber is mechanically thinned, but as the tree canopy is opened, the additional sunlight and precipitation reaching the ground spur a flush of grass and forb growth in the understory. As the aboveground portions of these herbaceous plants die annually, the amount of litter on the soil surface increases, which improves soil condition.
- Although the nature and degree of soil improvement and specific management activities and locations cannot be predicted in a programmatic environmental impact statement such as this, the relative number of projects and management activity acreages called for in the objectives of each alternative can be used for relative comparison of environmental consequences.
- On an acre-by-acre basis, the nature of the indirect effects of management activities that impact soil condition are not expected to differ by alternative, nor are they expected to differ based on where (wildland-urban interface, management area type, etc.) the activity occurs.
- Since VDDT modeling is not spatially explicit, alternative-specific projections of a vegetation type's structure (and consequent effects on soil condition) cannot take into account the specific location(s) of where any management action will (wildland-urban interface, restoration management area) or will not (recommended wilderness, conservation area, place-based management area) occur; only the alternative-specific forestwide acreages of proposed activity are taken into account. However, because alternative-specific plan components guide where vegetation management activity is most likely to occur (restoration management areas, wildland-urban interface) and least likely to occur (wilderness areas, conservation areas, site-specific management areas, etc.), effects of vegetation management are expected to be concentrated in wildland-urban interface and restoration management areas. Conversely, effects of lack of vegetation management are expected to be concentrated in wilderness areas, conservation areas, and place-based management areas such as are proposed in alternative B.

- Vegetation management-related objectives differ by alternative in annual acreage of managed wildfire and in mechanical treatment and prescribed fire in Ponderosa Pine Forest and Dry Mixed Conifer vegetation types (table 21). The rationale supporting differing, alternative-specific acreages of managed wildfire is related to fire suppression (or lack thereof) affecting other vegetation management activities (prescribed fire and mechanical treatment) in Ponderosa Pine Forest and Dry Mixed Conifer and to the Cibola's emphasis on improving conditions in these two departed, fire-adapted vegetation types. Therefore, effects of vegetation management activities on soil condition, including from wildfire, are expected to be generally similar among all alternatives for all vegetation types except for Ponderosa Pine Forest and Dry Mixed Conifer.
- Prescribed fire and mechanical vegetation treatments are specified to occur only in Ponderosa Pine Forest and Dry Mixed Conifer (table 21), although small-scale, ancillary activity in other vegetation types is possible. Hence, overall current conditions and trends for soil condition (as affected by vegetation management) in the remaining vegetation types are expected to continue, except where affected by the activities that may affect soil condition that vary by alternative.

Table 21. Activities and designations that are likely to impact soil condition that vary by alternative.

Activity or Area	Alternative A	Alternative B	Alternative C	Alternative D
Improve water resource features (for example, riparian areas, springs, streams) or soils to protect, maintain, or enhance unique places and features in priority areas	0 to 1 projects focused in priority watersheds annually	1 to 2 projects prioritized in 13 place-based management areas annually	2 to 5 projects prioritized in restoration and conservation management areas annually	2 to 5 projects focused in conservation management area annually
Relocate, improve, or decommission system roads or unauthorized routes to protect ecosystems and watersheds	Up to 1 mile annually	1 to 3 miles annually	3 to 5 miles annually	1 to 3 miles annually
Collaboratively develop or implement projects or activities to move rangelands towards desired conditions	5 to 10 partnerships annually	10 to 15 partnerships annually	15 to 20 partnerships annually	5 to 10 partnerships annually
Mechanically treat highly departed areas (for example, ponderosa pine and dry mixed conifer in fire-adapted ecosystems)	2,000 to 5,000 acres annually	2,000 to 5,000 acres annually	2,800 to 7,000 acres annually	2,000 to 5,000 acres annually
Prescribe burn to reduce wildfire risk and restore conditions	3,500 to 10,000 acres annually	4,200 to 12,000 acres annually	4,900 to 14,000 acres annually	4,200 to 12,000 acres annually
Manage naturally ignited wildfires for resource benefit	2,000 to 5,000 acres annually	2,200 to 5,500 acres annually	2,400 to 6,000 acres annually	2,200 to 5,500 acres annually

Environmental Consequences Common to Soils under All Alternatives that Vary by Vegetation Type

The effects on ecological indicators described in this section are assumed to move the Cibola toward or away from desired conditions in the same manner, and to the same degree, under all alternatives.

The vegetation-management plan components that differ among alternatives are the proposed objective acreages for mechanical treatment and prescribed fire in the Ponderosa Pine Forest and Dry Mixed Conifer vegetation types. For this reason, effects related to other vegetation types are expected to respond similarly among alternatives; however, these effects are expected to differ by system type (grassland, shrubland, etc.). As a result, effects common to all alternatives are addressed collectively for: all grassland, shrubland, and woodland vegetation types and the Spruce-Fir, and Wet Mixed Conifer forest vegetation types.[19] These consequences that are outlined by the aforementioned soil condition indicators will naturally shift in these vegetation types and under all alternatives without any influence from treatments identified within the land management plan objectives. That is, the effects common to all alternatives in these vegetation types result from lack of active management and are primarily driven by succession—progressive change in vegetation composition and structure over time (shifts in seral state proportions, increases in stocking density, fuel loading, etc.)—and incur associated changes in fire frequency and severity type, vulnerability to climate change and invasive species, etc.

Effects that differ by alternative primarily occur in the Cibola's two fire-adapted forest vegetation types (Ponderosa Pine Forest and Dry Mixed Conifer) where proposed objectives for vegetation management activities vary by alternative (table 21). Where not otherwise affected by activities or designations that are likely to impact soil condition that vary by alternative (table 21), soils are expected to be affected similarly under all alternatives within vegetation system type (grassland, shrubland, woodland, forest). Exception: soils of the two fire-adapted forest types on the Cibola (Ponderosa Pine Forest, Dry Mixed Conifer) would be affected differently by alternative and will be addressed by alternative in the sections that follow (below).

Vegetation management activities have a large impact on soil condition. While active vegetation management is less likely to occur in conservation management areas (alternative C) and recommended wilderness areas (alternatives B, C, D), these same areas would also be less likely to be treated under any alternative because they are generally remote and roadless. Objectives for place-based management areas do not specify any activity to occur; their desired conditions generally focus on maintaining their current characteristics. Under all alternatives, the wildland-urban interface is highly likely to be treated to protect resources both on, and adjacent to, the Cibola. Additionally, while restoration management areas may be a focus of activity under alternative C, some of these same areas are also likely to be treated under any alternative because of the Cibola's focus on improving the condition of highly departed fire-adapted forest vegetation types (Ponderosa Pine Forest and Dry Mixed Conifer).[20]

Soils of Grassland Vegetation Types

- Competition for sunlight, water, and soil nutrients by encroaching woody species (trees and shrubs) reduces understory productivity, plant cover, root growth, and litter production, and may reduce infiltration. In the absence of disturbance, soil biotic crusts may increase in response to diminished basal cover of understory plants. Encroaching trees and shrubs contribute coarse woody material which is uncharacteristic of grasslands. Moreover, encroachment causes an overall shift in the carbon storage profile, from being dominated by soil carbon in grasslands to aboveground carbon (woody vegetation) in forests, thereby altering ecosystem structure (Pinno and Wilson 2011) with unknown consequences. Managed wildfire may benefit the soils of these plant communities by restoring characteristic grassland structure by removing encroaching trees and shrubs.

[19] Effects to riparian systems are addressed in the Water Resources section (below).

[20] Juniper Grass Woodland is the Cibola's only other fire-adapted woodland or forest. It is projected to improve from being in moderate departure (currently) to low-departure over the life of the plan under all alternatives (table 9) without any proposed mechanical thinning or prescribed fire (table 2).

Soils of Shrubland Vegetation Types

- Competition for sunlight, water, and soil nutrients by encroaching trees reduces understory productivity, plant cover, root growth, and litter production, and may reduce infiltration. In the absence of disturbance, soil biotic crusts may increase in response to diminished basal cover of understory plants. Encroaching trees contribute coarse woody material which is uncharacteristic of shrublands. Moreover, encroachment causes an overall shift in the carbon storage profile, from being dominated by soil carbon in shrublands to aboveground carbon (trees) in forests, thereby altering ecosystem structure (Pinno and Wilson 2011) with unknown consequences. Managed wildfire may benefit the soils of these plant communities by restoring characteristic shrubland structure by removing encroaching trees.

Soils of Woodland Vegetation Types

- Competition for sunlight, water, and soil nutrients by continued overstocking of trees reduces understory productivity, plant cover, root growth, and litter production, and may reduce infiltration. In the absence of disturbance, soil biotic crusts may increase in response to diminished basal cover of understory plants. Currently, snags and coarse woody material for the Cibola woodlands is generally within historic levels (USDA Forest Service 2015a), but continued overstocking and uncharacteristically long fire return intervals may allow this material to accumulate to uncharacteristic levels; effects of wildfire on dead woody material is hard to predict. The effects of managed wildfire depend on the structure of these woodlands. If overstocked, soils burn long and hot, rendering the soil surface hydrophobic, thereby reducing infiltration and increasing runoff and erosion. If properly stocked, wildfire may provide overall benefit to soil condition by restoring historic fire regimes and reducing the risk of uncharacteristic fire by maintaining proper stocking levels.

Soils of Wet Mixed Conifer Forest and Spruce-Fir Forest Vegetation Types

- With soil condition rated 100 percent satisfactory and understory structure in low departure for both of these vegetation types, understory productivity, plant cover, root growth, litter production, infiltration, and soil biotic crusts are expected to remain relatively stable. Currently, snags and coarse woody material is in low departure, except for an underrepresentation of large snags in Spruce-Fir (USDA Forest Service 2015a) which, when combined with an almost complete lack of large trees in both of these vegetation types, could lead to decreases in large snags and coarse woody material in both of these vegetation types over time, reducing carbon inputs to soil and reducing wildlife habitat.

Environmental Consequences Common to Soils of All Vegetation Types that Vary by Alternative

Effects that are common to soils of all vegetation types but that differ by proposed management activity level among the alternatives are discussed in this section. Because these activities (table 21) do not specify the location or vegetation type where the activity will happen, these effects on soil will be discussed collectively in this section. These effects are addressed by management activity, and the nature of these effects is the same within a particular management activity. However, the magnitude of each effect varies by alternative and is directly proportional to the project activity level (number of projects, acreages, etc.).

Effect of Improving Water Resource Features or Soils

Projects to improve soils are often designed to reverse past damage (compaction or removal of plant cover). By indirectly (limiting local access, resting from livestock) or directly (reseeding) allowing plant cover to approach desired conditions, litter, soil biotic crusts, and infiltration are also expected to approach desired conditions.

Where improving water resource features involves improving access to water for livestock, concentrated animal presence in the immediate vicinity of the development may increase compaction and reduce infiltration, plant cover, litter, and soil biotic crusts. However, this local negative impact on soil condition is likely outweighed by widespread positive effects of improved animal distribution—including an overall healthier plant community (more plant cover, litter, infiltration, and soil biotic crusts)—beyond the immediate vicinity.

The number of annual projects to improve water resource features or soil varies by alternative (table 21), with alternatives C and D (2 to 5 projects) most quickly approaching desired conditions for soils, followed by alternative B (1 to 2 projects), and lastly, alternative A (0 to 1 projects).

Effect of Relocating, Improving, or Decommissioning System Roads or Unauthorized Routes

Road relocating, improving, or decommissioning projects to protect ecosystems and watersheds often aim to reduce surface runoff and erosion, allowing damaged soils to heal through site protection, rerouting overland flow of water, reducing erosion, reseeding or planting vegetation, etc., thereby increasing plant cover, litter, soil biotic crusts, and infiltration in adjacent plant communities. The number of miles of annual road-related projects that may improve soil condition varies by alternative (table 21), with alternative C (3 to 5 miles) most quickly approaching desired conditions for soils, followed by alternatives B and D (1 to 3 miles), and lastly, alternative A (up to 1 mile).

Effect of Collaboratively Developing or Implementing Projects or Activities to move Rangelands towards Desired Conditions

Projects or activities to move rangelands towards desired conditions are often designed to increase herbaceous plant productivity. This applies not only to grasslands and shrublands, but also to the herbaceous understories of woodlands and forests. Increasing herbaceous plant productivity improves soil condition by increasing plant cover, litter, soil biotic crusts, and infiltration. The proposed number of partnerships to develop or implement such projects annually varies by alternative (table 21), with alternative C (15 to 20) most quickly approaching desired conditions for soils, followed by alternative B (10 to 15), and lastly by alternatives A and D (5 to 10).

Environmental Consequences Common to Soils of Ponderosa Pine Forest and Dry Mixed Conifer Vegetation Types that Vary by Alternative

Effects that differ by alternative and by vegetation type primarily occur in the Cibola's two fire-adapted forest vegetation types (Ponderosa Pine Forest and Dry Mixed Conifer) where proposed objectives for mechanical treatment, prescribed fire, and managed wildfire vary by alternative (table 21).

Effect of Mechanical Treatment on Soil Condition

In the absence of mechanical treatment, soil condition is expected to decline, as continued overstocking diminishes understory productivity and reduces plant cover, litter, and infiltration; consequences to soil biotic crusts are hard to predict. Coarse woody material (currently at desirable levels) may continue to accumulate, but continued overstocking may lead to catastrophic, uncharacteristic, high-severity fire, possible reducing coarse woody material to undesirable levels.

Mechanical treatments may improve understory structure by reducing overstory density of overstocked stands, thus reducing competition in the understory for sunlight, water, and nutrients and increasing herbaceous productivity. As a result, soil condition is expected to improve with the increased plant cover, litter, and infiltration. Mechanical treatment may temporarily break up soil biotic crusts, but these are expected to recover in the long-term. Coarse woody material would be expected to remain at desirable levels.

The proposed number of acres of mechanical treatment varies by alternative (table 21), with alternative C (2,800 to 7,000) most quickly approaching desired conditions for soils, with no difference among alternatives A, B, and D (2,000 to 5,000 each), as they are expected to approach desired conditions less quickly than alternative C.

Effect of Prescribed Fire and Managed Wildfire on Soil condition

Prescribed fire and wildfire are expected to provide overall benefits to vegetation structure, and consequently to soil condition, by reducing stocking, thereby increasing understory productivity and plant cover, litter, and infiltration; consequences to soil biotic crusts are hard to predict. Patterns of benefit resulting from managed wildfire are expected to be less uniformly distributed and in larger patches than for prescribed fire. In fact, the effects of managed wildfire may be locally detrimental where severely overstocked stands burn excessively long and hot near the soil surface which can lead to a hydrophobic soil surface, thereby increasing runoff and erosion and reducing infiltration and killing soil biotic crusts. However, as natural fire regimes reestablish as a result, the overall benefit to soil condition is expected to be positive over the long term. Alternative C is expected to approach desired conditions for soil most quickly of all the alternatives because it has the most proposed acreage of prescribed fire and managed wildfire of any alternative (table 21), followed by alternatives B and D (equal acreages, less than C), with alternative A approaching desired conditions least quickly.

Cumulative Environmental Consequences

Soil condition is intricately associated with vegetation structure. The goal of vegetation management projects is generally to create vegetation structure conditions approaching historical conditions, including stocking level, fuel loading, and fire regime, and consequently, soil condition. Data are not available for off-Forest soil condition; however, conditions and trends in off-Forest vegetation may provide insight to cumulative effects on soil condition. Off-Cibola overall departure of vegetation structure was analyzed at the context scale[21] in the Cibola assessment (USDA Forest Service 2015a) and was generally found to be in similar or better (lower departure) condition compared to the Cibola. However, the context scale extends hundreds of miles from the Cibola in some instances, it does not include some portions of the Cibola in other instances. In this section, the area of analysis for cumulative environmental consequences includes all areas within ten miles of any part of the Cibola.

Ongoing and planned projects (over the life of the Cibola land management plan) occurring within 10 miles of the Cibola were identified in the New Mexico vegetation treatment geodatabase, created by the New Mexico Forest and Watershed Restoration Institute (NMFWRI) for the Forest and Watershed Health Coordinating Group (https://nmfwri.org/gis-projects/nm-vegetation-treatment-mapping). This geodatabase allows the user to visually identify specific projects interactively in an on-line GIS interface and to download text files with detailed information for each project.

[21] The "context" scale" is the cluster of all ecological subsections (McNab et al. 2005) that intersect at least 1 percent of the Cibola.

These off-Cibola vegetation management projects are expected to reduce the risk of uncharacteristic, stand-replacing wildfire, which can degrade soil condition. Over 15,000 acres of vegetation management projects are scheduled to occur off the national forest (table 18).

At the landscape level, direct wildfire-related cumulative effects on soil condition (reduced plant cover, litter, infiltration, soil biotic crusts, coarse woody material) are expected to be greater on the Cibola than on adjacent land—and vice-versa—indirect effects (soil erosion, runoff) are expected to be greater off the national forest. This is because fires tend to move uphill faster than downhill. During the daytime when conditions are most conducive to combustion (higher temperatures, lower humidity), wind currents typically move uphill as the as the earth warms; the steeper the slope, the faster the fire travels. Additionally, fuels are preheated as heat from the fire approached from below. Most of the land adjacent to the Cibola is lower in elevation (downhill), with slope tending to increase uphill (onto the Cibola). Conversely, indirect effects (post-fire soil erosion, surface runoff, flooding) are manifested, and often compounded, as they travel downhill.

As project-level work improves soil condition on the Cibola, other watershed-related benefits (reduced runoff, raised water tables, reduced stream sedimentation, etc.) may be realized in areas adjacent to, and downhill from, the Cibola. Off the national forest, vegetation management is expected to reduce wildfire risk on the Cibola, thereby reducing the potential negative effects on soil condition.

Air Resources

Air is an important resource for forest resources as a requirement for life. The presence of air is a given, however the quality of air is variable and can have effects on forest resources. Air quality can affect visibility, water quality, public health, and ecosystem health. Air quality has long been recognized as an important resource to protect on national forests. Not only does the public value the fresh air and sweeping views national forests can provide, but forest health, water quality, and fisheries are also highly valued and are just a few resources that can be affected by poor air quality. The basic framework for controlling air pollutants in the United States is mandated by the Clean Air Act, originally adopted in 1963, and amended in 1970, 1977, and 1990. The Clean Air Act was designed to "protect and enhance" air quality.

This section describes the existing environment for air resources of the Cibola National Forest. Air resources can be impacted by sources outside the Cibola and from sources that originate from the Cibola. Air resources are addressed in different ways, depending on the source of the emissions. This report describes the current conditions and trends regarding air quality in the plan area. Air quality refers to the condition of the air that surrounds us. It is determined through the measurement of the components of the air, some of which constitute pollutants because they impact human and environmental health. The Clean Air Act required EPA to set national ambient air quality standards. There are six principal pollutants, called 'criteria' air pollutants. These standards represent maximum air pollutant concentrations which protect public health and welfare. These pollutants are carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), lead (Pb), and particulate matter (PM_{10} and $PM_{2.5}$). PM_{10} is particulate matter with a diameter of 10 micrometers or less (one seventh the diameter of a human hair which is about 100 micrometers). $PM_{2.5}$ is particulate matter with a diameter of 2.5 micrometers. For a more complete discussion of air resources, please see the Cibola National Forest Mountain Ranger Districts Assessment Volume 1, Ecological Assessment (USDA Forest Service 2015a).

Affected Environment

National and State Ambient Air Quality Standards

For the Cibola, most of the nearby ambient air quality monitoring stations are located in the greater Albuquerque metropolitan area. Ambient air quality measurements were collected between the years 2000 and 2010 at New Mexico monitoring sites in and near the Cibola. Lacking other data collected in more remote settings, the reported data are the best available information to characterize exiting air quality conditions for the planning area. Therefore, this monitoring data depicts concentrations pollutants which have the potential to cause adverse health effects in the general population, adverse ecological effects, or both.

If an area in a state has air quality worse than the national ambient air quality standards, that area becomes a nonattainment area. Once a nonattainment area meets the standards and that area can be designated as a maintenance area. At the present time, the plan area attains all national and New Mexico ambient air quality standards. State standards, established by the New Mexico Environmental Improvement Board and enforced by the New Mexico Environment Department, Air Quality Bureau, are termed the New Mexico ambient air quality standards. The New Mexico standards must be at least as restrictive as the national ambient air quality standards. The New Mexico standards also include standards for total suspended particulate matter, hydrogen sulfide, and total reduced sulfur for which there are no national standards.

The New Mexico Environment Department Air Quality Bureau enforces air pollution regulations and sets guidelines to attain and maintain the national and state ambient air quality standards within the state of New Mexico, except for tribal lands and Bernalillo County which maintain separate jurisdictions. Dona Ana County is the only area in New Mexico currently in nonattainment for particulate matter 10 (PM_{10}); the area is approximately 45 miles south of the Magdalena Ranger District.

Sources of Air Pollution Emissions

Air quality effects on national forests are generally traceable back to the original source of emissions; therefore, air emissions information provides an overview of the magnitude of air pollution and is important in understanding air quality on the Cibola. Emissions inventories are created by quantifying the amount of pollution that comes from point sources (power plants, factories) and area sources (emissions from automobiles in a city or oil and gas development). Emissions can also originate from natural events like a wildfire. Some of the sources originate within the plan area. Most have their origin outside the plan area.

For carbon monoxide, nitrogen oxide, and sulfur dioxide emissions, the trend shows a projected decrease in statewide emissions through 2018. Most of the reductions for carbon monoxide and nitrogen oxide emissions are from fewer mobile source emissions and are associated with the introduction of lower emitting vehicles over time, cleaner transportation fuels, and improvements in vehicle gas mileage. Sulfur dioxide emissions show improvement over time largely from reductions in stationary source emissions, such as coal-fired power plants, which are expected, in the near term, to install emission controls defined as best available retrofit technology under the regional haze regulations. Some decrease in sulfur dioxide emissions occurs from mobile sources and is associated with cleaner transportation fuels, such as the introduction of low-sulfur diesel fuel. The expected increase in oil and gas industry activity through 2018 increases emissions of nitrogen oxides and sulfur dioxide, which offsets some of the emissions decreases described above.

The general trend at state and county levels is for most of the emissions of carbon monoxide, nitrogen oxides, and sulfur oxides to decrease through 2018. There are however, some notable exceptions. Nitrogen oxides and sulfur oxides are expected to increase in Bernalillo and Sandoval Counties from area sources primarily driven by industrial stationary source fuel combustion. Point source emissions of sulfur oxides are expected to increase in McKinley Country. Also of note is that wildfire emissions are a significant source of carbon monoxide. The county-by-county emissions trends through 2018 generally share the patterns of decline described above.

The primary sources of coarse and fine particulate matter are windblown dust across the land and fugitive dust from human sources. Particulate matter levels are expected to increase across New Mexico through 2018, consistent with the projected population growth in the state. Higher temperatures and persistent drought could exacerbate this trend (Prospero and Lamb 2003).

In addition to the national ambient air quality standards, Bernalillo County regulates fugitive dust to ensure reasonably available control measures or other effective measures are used to prevent or abate fugitive dust where there is a reasonable probability of injury to health, risk to public welfare, visibility, or reasonable use of property. Lands within the plan area in Bernalillo County are subject to this regulation. Currently, the Cibola has a programmatic permit for 32 acres subject to routine maintenance and use of unpaved roads and trails designated for motorized use.

Emissions information is important, as adverse air quality impacts on the Cibola can usually be traced to air emissions. Knowing the magnitude of emissions and recognizing trends in emissions over time are important because emissions are usually correlated to the type and severity of air quality impacts. Often, adverse air quality impacts to air-quality-related values can be mitigated through programs that reduce associated air emissions. However, the Forest Service typically lacks direct authority to control air emissions that impact a particular ranger district.

Forests play an important role in carbon sequestration, which is the direct removal of carbon dioxide from the atmosphere through biologic processes, such as forest growth. Carbon sequestration by forests is one way to mitigate greenhouse gas emissions by offsetting losses through removal and storage of carbon (USDA Forest Service 2015). Over at least the past several decades, temperate forests have provided a valuable ecosystem service by acting as a net sink of atmospheric carbon dioxide, partly offsetting anthropogenic emissions (Millar and Stephenson 2015). Carbon dioxide uptake by forests in the conterminous United States offset approximately 16 percent of our national total carbon dioxide emissions in 2011 (U.S. Environmental Protection Agency 2013). Forests and other ecosystems generally act as carbon sinks because, through photosynthesis, growing plants remove carbon dioxide from the atmosphere and store it (USDA Forest Service 2015).

Keeping forests as forests is one of the most cost-effective carbon storage measures, as is restoration which brings back badly altered forests and grasslands to producing a full range of environmental services (USDA Forest Service 2015).

Emission from Plan Area Activities

Several activities occurring within the plan area have the potential to affect air quality (table 22). Wildfire, managing naturally ignited wildfire, and prescribed fire have the potential for visible short-term effects due to their nature. Best management practices are used to mitigate effects to air during all activities. In particular, there are specific smoke management guidelines and a permit system. Air on the Cibola is in good condition; however, visibility and air quality may decline if particulate matter increases—a likely result of larger, more severe wildland fires as the effects of climate change are realized.

Table 22. Emission sources from forest activities

Activity	Direct and Indirect Effects	Influencing Factors	Forest Level Mitigation
Use of unpaved roads	Dust particulates	Varies with volume of traffic, condition of road, fraction of silt in road surface materials, vehicle weight, moisture content of road surface material	Road management plan, standards and guidelines, best management practices
Use of paved roads	Dust, brake wear, tire wear, pavement wear, particulates	Varies with amount of traffic, condition of road, temperature, vehicle weight, tire, and surface material. Also, seasonal inputs related to snow and ice controls such as salt and sand.	Road management plan, standards and guidelines, best management practices
Motor vehicles including all-terrain vehicles and snowmobiles.	Exhaust, carbon monoxide, hydrocarbons, nitrogen oxides, particulates, air toxics	Varies with amount of traffic.	Maintain Forest Service motor vehicles. No control over motor vehicles owned by others. Local, State, and Federal regulations will mitigate.
Wildfire, managing naturally ignited wildfire, and prescribed fire	Smoke particulates, carbon monoxide, volatile organics, nitrogen oxides, carbon dioxide, air toxics	Varies with intensity and rate of fire, fuels type, topography,	Fire management plan and associated mitigations, Burn plans, best management practices
Construction and building activities	Dust exhaust, particulate matter, carbon monoxide hydrocarbons, nitrogen oxides, carbon dioxide	Varies with size of equipment, size of area, weather conditions during activity,	Standards and guidelines, contract provisions, best management practices
Campfires	Smoke particulates, carbon monoxide, volatile organics, nitrogen oxides, carbon dioxide, air toxics	Varies with size, concentration, topography, weather conditions.	Backcountry rules, forest protection areas

Currently, there is no data on the impact of Cibola National Forest activities on air quality within the plan area. The effect of forest activities on air quality is mitigated through the use of best management practices. Prescribed fire activity is required to utilize best management practices to reduce the impact of burning on air quality and sensitive populations. The effects of wildfire activity are harder to control and often results in large emission inputs to the air. Air quality monitoring at fixed locations described in this report indicate that overall, air quality standards are being met. These do not measure the impacts of specific activities. However, since no areas are listed as nonattainment in the vicinity of the plan area, none of the activities in contributing to nonattainment of air quality standards.

Air-Quality-Related Values

Air-quality-related values are resources which could be impacted by air quality. These values include visibility, human health, water quality soil quality, and ecosystem impacts. Each air-quality-related value has a critical load. The critical load is the amount of a specific pollutant that causes harm to an air-quality-related value. Under the Clean Air Act, Class 1 parks and wilderness areas have to protect air-quality-related values and consider whether proposed major emitting facility will have an adverse impact on such values. The Cibola does not manage any Class 1 areas; however, several nearby Class 1 areas could be affected by projects and sources on or near the Cibola. They include the San Pedro Parks Wilderness, Bandelier National Monument, and the Pecos Wilderness. The closest Class 1 areas to the south of the Magdalena and Mountainair Ranger Districts are the Gila Wilderness, the Bosque del Apache National Wildlife Refuge, and the White Mountain Wilderness. Because there are no Class 1 areas within the plan area, the Cibola does not have any regulatory responsibilities to protect air-quality-related values in the plan area. However, it is an important concept to consider during land management activities. To this end, Cibola personnel have established critical loads based on a national assessment developing empirical critical loads for major ecoregions across the United States. Data about air-quality-related values and critical loads in the plan area are reported in detail in the assessment report (USDA Forest Service 2015a).

Summary

The ecosystem services provided by air are generally stable and not at risk. Air quality on the Cibola is within regulatory levels for national ambient air quality standards, and the trend based on projected emission inventories appears to be stable or is improving for most pollutants (table 23 and table 24). This is also true regarding visibility conditions. The main challenge could be with regards to both coarse and fine particulate matter, which can affect both the ambient air quality and visibility on the Cibola National Forest. Land use on and off the Cibola, as well as climate change and drought, can contribute to windblown and fugitive dust. Wildfires can also be a significant source of particulate matter.

There is some indication current levels of nitrogen deposition have exceeded critical loads and are significant enough to have resulted in impacts to lichen diversity and community structure and to a lesser degree impacts to herbaceous plants and shrubs (table 24). However, these results were based on modeled critical loads and have not been verified on the Cibola National Forest. The rate of deposition of nitrogen, which can lead to impacts affecting forest health, appear to be decreasing based on projected emissions at the state level. Modeled results also indicate the levels of acid gases are not significant enough to result in impacts to either soils or surface water. There are no direct measurements on the Cibola that indicate otherwise. Acid gases, such as sulfuric acid, most often are formed from sulfur dioxide released when coal, oil, and gas are burned.

There is some indication mercury deposition at higher elevations on the Cibola may be significant, but there are not any studies to verify any impacts. Atmospheric mercury, based on regional emissions, is also expected to decrease.

Table 23. Summary of conditions, trends, and reliability of assessment for national ambient air quality standard pollutants and visibility

Air Quality Measure	Current Conditions	Trend	Reliability
Carbon monoxide*	Good	Improving	High
Nitrogen dioxide*	Good	Improving	High
Sulfur dioxide*	Good	Stable	High
Lead*	Good	Stable	High
Ozone*	Good	Stable	High
$PM_{2.5}$*	Good	Stable to declining	High
PM_{10}*	Good	Stable to declining	High
Visibility†	Departed	Stable to improving	High

*Relative to national ambient air quality standards

†Relative to 2064 regional haze goal

Table 24. Summary of conditions, trends, and reliability of assessment for critical loads for nitrogen eutrophication, acid deposition, and other deposition

Air Quality Measure	Current Conditions	Trend	Reliability
Lichens (nitrogen eutrophication)	Potentially at risk	Improving	Low
Herbaceous plants and shrubs (nitrogen eutrophication)	Potentially at risk	Improving	Low
Soils (acid deposition)	Good	Improving	Low
Surface water (acid deposition)	Good	Improving	Low
Mercury (other deposition)	Potentially at risk	Improving	Low

Environmental Consequences

Methods of Analysis

The potential effects to air quality from direction given in the no-action alternative to the action alternatives are compared. Several activities that could originate on the Cibola could be sources of potential emissions as shown in table 22. Of these activities, emissions from prescribed fire and managing naturally ignited wildfire are the only things with the potential to vary by alternative. These effects are modeled and are analyzed in further detail. Emissions related to the other activities on the Cibola would not vary greatly by alternative. These are discussed qualitatively below.

Emissions for carbon dioxide and $PM_{2.5}$ (fine inhalable particles, with diameters generally 2.5 micrometers and smaller) were modeled for the objectives for prescribed fire and managing naturally ignited wildfire that vary for each alternative as shown in figure 4 and figure 5. Emissions from fire is the only effect analyzed quantitatively for air quality since the emissions from this activity far outweigh all other possible emissions. $PM_{2.5}$ was modeled due to the concern to impacts to public health, national ambient air quality standards, and visibility. Carbon dioxide was modeled due to its contribution to climate change. For each alternative, the upper target range of acres in the ranges for objectives were used in the model.

Consume, version 4.2 (USDA Forest Service 2015c) was used to model smoke emissions from the three action alternatives and the no-action alternative. Consume is a fuels model commonly used to estimate smoke emissions. Basic input data, such as fuel types, the type of fire (prescribed fire or managing naturally ignited wildfire), the condition of the unit (has it been mechanically treated), and environmental conditions (fuel moisture) are entered into the model. The model then estimates emissions for a variety of pollutants, such as $PM_{2.5}$ and carbon dioxide. For each alternative, the forest defined objective a range of treatment acres for prescribed fire and managing naturally ignited wildfire. To bound the analysis, the alternatives were modeled based on high end of the objectives for treatment between alternatives to estimate annual emissions. However, treatment objectives may not be met, and actual acres treated will vary. Fuels moistures were used consistent with conditions in which prescribed fire or managing naturally ignited wildfire would take place. For each fuel type, it was assumed fire suppression and grazing had affected the fuel loads, by increasing the standing biomass in each fuel type, from a natural fire regime that would have reduced the biomass available to burn. A complete set of assumptions and outputs for all pollutants modeled is in the Cibola administrative project record.

Indicators

- Modeled emissions of carbon dioxide and $PM_{2.5}$ based on acres of prescribed fire and managing naturally ignited wildfire

Assumptions

- Sources of ambient pollution other than fire, produce emissions on the Cibola that would not vary greatly by alternative.
- Air quality would continue to meet or exceed State and Federal ambient air quality standards.
- Practices such as thinning and prescribed fire may release carbon in the short term, but they focus growth and carbon storage for the future on trees that are at lower risk and/or are more resilient to disturbance.
- High-severity fire has the potential to be a carbon source for decades post fire compared to 2 to 3 years post treatment from prescribed fire (Dore 2012). Because live trees continually sequester carbon and are a more stable carbon sink than dead biomass left on the site, treating stands is preferred for long-term mitigation of atmospheric carbon levels (Vegh et al. 2013).
- Management activities would not adversely impact Class 1 airshed visibility as established in the Clean Air Act.

Environmental Consequences Common to All Alternatives

Vehicle emissions associated with road work, administrative use, on- and off-road travel, and recreational vehicle use release combustion gases (exhaust) and particulates to the air, which contribute to ambient concentrations of pollutants regulated by the national ambient air quality standards. Most of these emissions are confined locally, are temporary, and are not expected to negatively affect ambient concentrations which are very good. Due to the high level of uncertainty associated with any analysis of these emissions, that they are relatively insignificant, that they are unlikely to vary substantially between alternatives, and are unlikely to have a negative effect on meeting any regulatory standards or on visibility or deposition of pollutants, these emissions were not analyzed.

Roads, motorized trails, and gravel pits produce fugitive dust, but it is not expected to have a significant impact on air quality nor vary between alternatives. Impacts from these types of emissions were not directly analyzed. This is also due to the high degree of uncertainty associated with such an analysis and the fact that air quality in the project area is considered to be very good, such that the relatively small amount of emissions from such actions would be considered negligible to the broader airshed. Any actions, such as building roads or the use of gravel pits, are likely to last for a very short period—a few months rather than years—and the dust would be isolated to very small areas and would not pose a threat to visibility or air quality standards. In addition, fugitive dust from the construction, operation, and maintenance of roads could be reduced by Federal contract requirements dictating standard specifications and best management practices to reduce fugitive dust, if deemed necessary for a particular contract.

Mechanical treatment of vegetation is used to reduce high concentrations of fuels in the forest understory, which, in turn, lowers the risk of severe wildfire and its effects on the health and safety of fire management personnel and improves habitat for a variety of species. Removing woody debris and plant material on the forest floor is often done prior to planned fire ignitions. Operation of chainsaws and chippers releases exhaust and particulates to the air, and burning the larger branches, twigs and other woody debris (referred to as slash) generates smoke, the effects of which are discussed below. Due to the high level of uncertainty associated with any analysis of these emissions, that they are relatively insignificant, that they are unlikely to vary between alternatives, and are unlikely to have a negative effect on any regulatory standards, visibility or deposition of pollutants, these emissions were not analyzed.

Currently there is no active commercial leasable or locatable minerals production in the plan area. However, substantial forest lands are open to consideration for locatable and leasable development. Commercial oil, gas, and geothermal development and uranium mines could include a wide variety of operations including wells, roads, buildings, storage areas, and mining vents. These processes release several types of emissions, including methane (a greenhouse gas), volatile organic compounds which are precursors to ozone, nitrogen oxides, and others. Generally, these emissions are controlled by best management practices required under individual leases and by State and Federal law. Emissions related to mining activities are not expected to vary by alternative and were not analyzed in this analysis.

Under all alternatives, wildland fires will continue to occur within the plan area and will be managed according to policy and guidance set forth under each alternative. Smoke from wildland fires may travel large distances, impairing local and regional visibility and degrading air quality far from its point of origin, depending on topography and atmospheric conditions—in particular, wind speed and direction. In the case of wildfire, ambient concentrations of criteria pollutants may increase beyond the national ambient air quality standards both locally and in locations in other states, regardless of which revised land management plan is in effect. The occurrence of wildfire is expected to increase, regardless of Cibola National Forest activities, due to an increase in drought. Thus, any adverse health effects on sensitive populations would be equal for all alternatives.

The 1985 plan requires that every forest action be designed to comply with the all applicable air quality regulations. It also specifies best management practices be applied to activities that generate air pollutants to reduce or mitigate potential adverse impacts. All the alternatives propose equivalent air quality protection. Therefore, there is no difference among the alternatives with regard to protection of ambient air quality and effects on human health.

Alternative A

Alternative A is the existing condition and is described in the affected environment. The modeled emissions for this alternative represent the baseline condition to which alternatives B, C, and D are compared. Alterative A proposes to treat up to 10,000 acres annually with prescribed burns. In addition, the 1985 plan indicates that up to 5,000 acres a year could be treated with managed wildfire annually. Its possible more acres could be treated in any one year, depending on conditions. Treatments would provide some minor offsetting of potential impacts of carbon emissions due to more fire-created openings, aspen regeneration, and a reduction in the overabundance of fire sensitive species.

Based on these acreages, the modeled emissions are 262,956 tons of carbon dioxide and 1,438 tons of $PM_{2.5}$ annually. To put these numbers in perspective, the $PM_{2.5}$ emissions are about twice the emissions of an average coal-fired power plant annually (NADP 2011). Regarding carbon dioxide emissions, a typical coal-fired power plant generates approximately 3.9 million tons of carbon dioxide per year (U.S. Environmental Protection Agency 2018), which is about 15 times greater than the annual emissions from wildland fire in this alternative. Treatments would provide some minor offsetting of carbon emissions through sequestration.

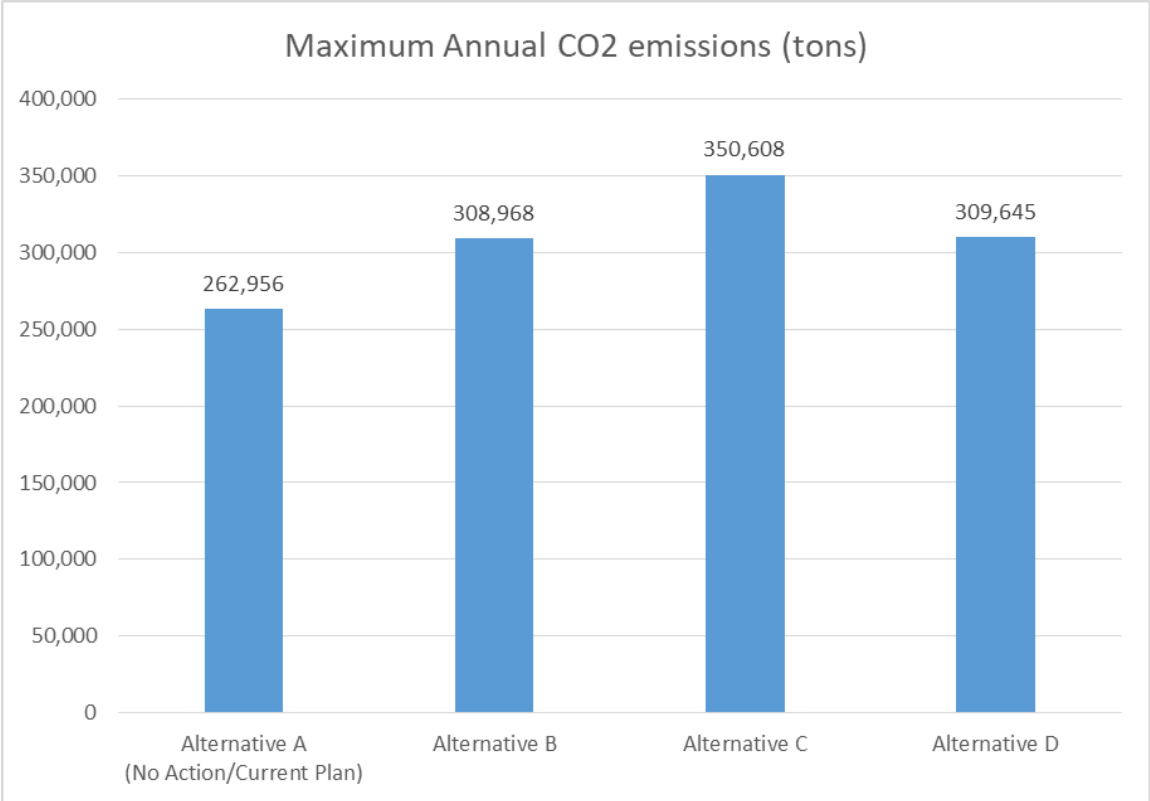


Figure 4. Maximum annual carbon dioxide emissions in tons

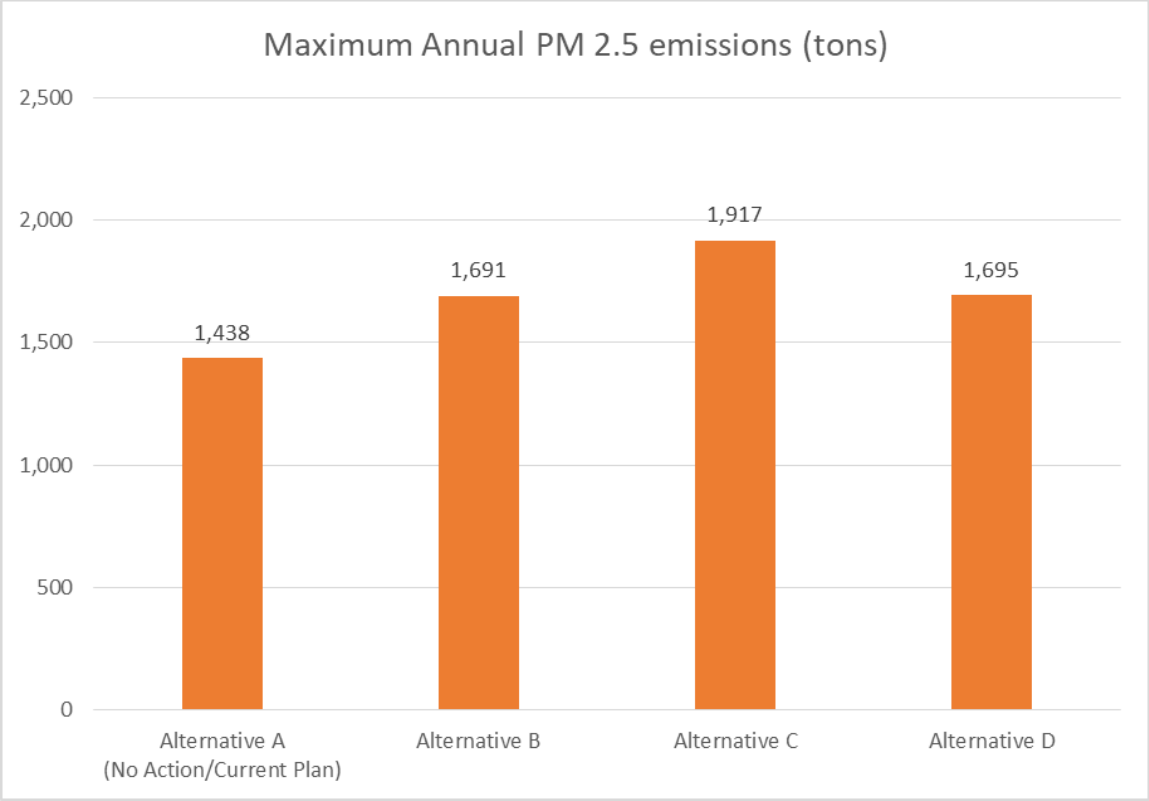


Figure 5. Maximum annual $PM_{2.5}$ emissions in tons

Environmental Consequences Common to Action Alternatives, B, C and D

Alternatives B, C, and D provide additional direction that emphasizes meeting or surpassing State and Federal ambient air quality standards; ensuring that there are no measurable disturbances to water chemistry or biotic components due to atmospheric deposition of pollutants; maintaining or improving visibility; and ensuring that sensitive areas and receptors are not negatively impacted by smoke. These would be accomplished by coordination and permitting with agencies, organizations, tribes, stakeholders, and other entities to actively pursue actions designed to reduce the impacts of pollutants from sources both within and outside the Cibola, monitoring of critical loads on the Cibola National Forest so deposition levels can be communicated to regulators, and managing smoke in conjunction with the State of New Mexico and Bernalillo County through compliance with their respective smoke management programs. These actions would better align forest management with the goals and objectives of the Clean Air Act and its amendments, the regional haze rule, and New Mexico State implementation plans.

Environmental Consequences – Alternative B

Alternative B proposes to treat up to 12,000 acres with prescribed fire and 5,500 acres by managing naturally ignited wildfire. Total carbon dioxide emissions from alternative B would be 308,968 tons per year. This is a 17.5 percent increase in carbon dioxide emissions over alternative A. $PM_{2.5}$ emissions would be 1,691 tons per year, an increase of 17.6 percent (see figure 4 and figure 5). This alternative would treat 16.7 percent more acres with fire than alternative A.

The effects of carbon sequestration over the life of the land management plan from the proposed forest treatments in the management objectives for alternative B for emissions of $PM_{2.5}$ and carbon dioxide over time are uncertain but could be significant, especially regarding the emissions of these pollutants produced from wildfire. The emissions presented in figure 4 and figure 5 represent estimated direct emissions from treatment options and not the indirect and avoided emissions associated with this alternative. For example, the particulate matter emissions do not represent the emissions from a wildfire that could occur after treatment occurs which would result in less emissions (due to the removal of material that produces emissions from treatment) nor does it represent the emissions that could occur from a wildfire in an area that has not had treatment that would likely result in greater emissions due to the similar fuel loading but hotter dryer conditions that are likely to occur during a wildfire. Due to the high level of uncertainty in these scenarios, no quantitative analysis was conducted but these effects can be described qualitatively, especially for carbon dioxide emissions where the indirect effects are more certain.

Alternative B would restore (mechanical treatment and prescribed fire) about 13 percent more acres annually than the current land management plan, which would result in greater potential for carbon sequestration over the life of the land management plan.

Environmental Consequences – Alternative C – Accelerated Restoration

Alternative C proposed to treat up to 14,000 acres with prescribed fire and 6,000 acres by managing naturally ignited wildfire. Total modeled carbon dioxide emissions from alternative C would be 350,608 tons per year. This is a 33.3 percent increase in carbon dioxide emissions from alternative A. $PM_{2.5}$ emissions calculate to 1,917 tons per year, also an increase of 33.3 percent. This alternative would treat 33.3 percent more acres with fire than the 1985 plan.

Alternative C includes the same plan direction as alternative B and impacts on air quality from management objectives other than emissions from fire would not be expected to vary greatly between any of the alternatives.

As in alternative B, the effects of emissions in terms of carbon sequestration are highly uncertain but potentially significant in alternative C. Alternative C would restore (mechanical treatment and prescribed fire) about 40 percent more acres annually than alternative A, which would result in greater potential carbon sequestration over the life of the land management plan.

Environmental Consequences – Alternative D

Alternative D proposed to treat up to 12,000 acres with prescribed fire and 5,500 acres by managing naturally ignited wildfire. Total modeled carbon dioxide emissions from alternative D would be 309,645 tons per year. This is a 17.8 percent increase in carbon dioxide emissions from alternative A. $PM_{2.5}$ emissions are modeled at 1,695 tons a year, an increase of 17.9 percent (figure 4 and figure 5). This alternative treats 16.7 percent more acres with fire than the 1985 plan.

Alternative D includes the same plan direction as alternative B and impacts on air quality from management objectives other than emissions from fire would not be expected to vary greatly between any of the alternatives.

As in alternatives B and C, the effects of emissions in terms of carbon sequestration are highly uncertain but potentially significant in alternative D. Alternative D would restore (mechanical treatment and prescribed fire) about 13 percent more acres annually than alternative A, which would result in greater potential carbon sequestration over the life of the land management plan.

Cumulative Environmental Consequences

The cumulative effects are changes to air-quality-related values on the Cibola National Forest as a result of cumulative inputs to the air. These inputs occur from within the plan area as well as outside of the plan area, including global sources. Effects to air-quality-related values are the result of cumulative input to the air from a multiple of sources, within and outside the plan area. Cumulative effects from prescribed fire and managing naturally ignited wildfire on Federal, State, and tribal lands are largely addressed by the New Mexico State Implementation Plan (20.2.65.1 New Mexico Administrative Code). Table 23 and table 24 show that while the current is "good" to "potentially at risk" for some values, the trend for all values is expected to improve.

The cumulative effects area for air resources are primarily the area within 300 kilometers (186 miles) of the mountain districts. However, emissions that can lead to impacts on the Cibola can originate both in other states further than 300 kilometers (186 miles) away but also from other countries thousands of kilometers away as well, from wildfires, dust, or emissions from fossil fuel burning. The sources of emissions listed below include the main sources of emissions and are consistent across all alternatives.

Sources of Emissions from Lands of Other Ownership

No sources of industrial emissions are generated by Cibola National Forest activities. Therefore, the Cibola would not contribute to adverse impacts if new or expanded industrial sources are developed.

Off-forest sources of emissions that may contribute additively to cumulative effects are those that would disturb soils, such as residential and commercial development, energy production and development, and road construction. Vehicle travel on adjacent roads and highways and agricultural activities (which produce exhaust gases and fugitive dust), industrial facilities from which point-source (for example, smokestack) pollutant emissions are released, and smoke from fires on land under private or other agency jurisdiction also contribute to cumulative effects. When considered additively with Cibola actions, the activities most likely to contribute to cumulative air quality impacts are wildland fire on adjacent lands, fugitive dust, energy production, and vehicle emissions.

Population growth and development in the New Mexico are expected to continue over the life of the land management plan. Areas adjacent to the Cibola, especially the Albuquerque metropolitan area, are expected to continue to grow. With projected growth, new construction of residential and commercial developments and roads is likely, and new ground disturbances would contribute additional fugitive dust to the ambient air. Likewise, an influx of more people would trigger more vehicle travel on local roads, increasing exhaust and dust emissions in the area impacts. Future proposed actions on the Cibola would be evaluated to determine if, when added to sources off the national forest, they would exacerbate nonattainment or increase haze and decrease visibility in both the local airshed and in Class 1 areas.

Industrial sources of air pollutants near the forests include power plants, factories, and other facilities that release pollutants from a single point. Air emissions from each of these are regulated under permits by the state and local environmental agencies. Therefore, if new significant sources of this kind are proposed, the increment of criteria pollutants, greenhouse gases, and hazardous substances would be reviewed by regulators. Mitigation and monitoring would be required to ensure continued attainment of the national ambient air quality standards.

Planned and unplanned fire ignitions may produce smoke, from which primary, secondary, and hazardous pollutants are released to the atmosphere. Planned ignitions are applied under the direction of a Federal, State, or local land management agency after consideration of variables such as weather, acreage to be treated, type and condition of fuels, and duration, among other factors. Authorization for planned ignitions by New Mexico is based, in part, on consideration of the potential for cumulative effects from smoke with other activities planned during a concurrent timeframe. Therefore, the potential for significant cumulative effects from planned ignitions is largely avoided or in some cases, mitigated by adherence to the smoke management program in the State implementation plan.

The occurrence and extent of wildfire are not predictable, and when uncharacteristic fires occur, their high intensity may result in temporary violations of the national ambient air quality standards in the affected airshed(s). The effects of wildfires are not considered additive with planned Cibola National Forest activities because they are unplanned events.

Conclusion

Under each alternative, the potential for significant air quality impact could occur, due to wildland fire. Alternatives B, C, and D are improvements over the 1985 plan in that added direction is included in all three that would improve the management of air quality on the Cibola in terms of impacts from wildland fire and monitoring of critical loads. Alternatives B, C, and D have potential direct emissions that are greater than the 1985 plan by 70 percent, 50 percent, and 85 percent respectively. The potential indirect effects from carbon dioxide emissions through carbon sequestration could reduce carbon dioxide emissions when compared to the 1985 plan. While highly uncertain, the potential reduction in carbon dioxide emissions between alternatives is proportional to the acres treated. As a result, while all would be improvements to the 1985 plan, the greatest potential is in alternative D, followed by B and C. There are significant uncertainties between all alternatives in terms of the effects on air quality due to the unknowns such as climate and the amount of wildland fire that could occur.

Fire and Fuels

Affected Environment

The vegetation communities on the Cibola have evolved through the periodic occurrence of fire on the landscape and as such are fire adapted in various ways according to the climatic-elevational gradients that have shaped the vegetative types. The resulting fire regimes have differing levels of expected fire behavior and frequency. The largest area by acreage is comprised of juniper woodlands which are fire regime 3 (moderate frequency and mixed severity). Ponderosa pine forests make up the next largest area and are fire regime 1 (frequent fire interval with low to mixed severity). Grassland and shrublands are the next major types and are fire regimes 2 (high frequency and severity), 3 (moderate frequency and mixed severity) and 4 (moderate frequency and high severity). The remaining 3 percent of the area is classified as woodlands and riparian (fire regimes 1 and 4 or similar to adjacent fire frequencies) respectively.

Wildfire hazard on the Cibola is a product of the vegetation type and condition (including fuel loading) as well as the daily weather and overall climate for the area. The Cibola National Forest and surrounding areas contain numerous highly valued resources and assets that can be impacted by fire. The effect of wildfire on the wildland-urban interface and municipal watersheds ranks as high in consideration for potential impacts, as do ecosystem function, infrastructure, and tribal values. Other identified assets are wildlife habitat, recreation, timber, and rangeland values.

Condition

Across most of the Cibola, the historical fire regimes are largely departed from pre-European conditions. One of the most apparent and critical changes in the Cibola National Forest is the vulnerability to uncharacteristic high-severity fire. Such fires not only pose safety risks and valuable losses to human interests but can drastically change and damage the ecological integrity of each ecological system. In general, areas with higher departures from historical conditions will result in higher wildfire hazards, although in some cases high wildfire hazard exists when that vegetation type is within its natural range of variation. The potential for increased fire intensity and severity most often occurs under weather conditions that represent the upper level of fire climatic conditions under which fires occur. The potential threat of high-intensity fire affecting the growing wildland-urban interface is of particular concern since it has the potential to impact public and firefighter safety.

Fire regime condition class is a classification of the amount of departure from the natural regime. Coarse-scale fire regime condition classes have been defined and mapped and include three condition classes. The classification is based on a relative measure describing the degree of departure from the historical natural fire regime. This departure results in changes to one (or more) of the following ecological components: vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances (for example, insect and disease mortality, grazing, and drought). All wildland vegetation and fuel conditions or wildfire hazard situations fit within one of the three classes.

Characteristic vegetation and fuel conditions are considered to be those that occurred within the natural (historical) fire regime. The vegetation communities on the Cibola have evolved through the periodic occurrence of fire on the landscape and as such are fire adapted in various ways according to the climatic-elevational gradients that have shaped the vegetation types. The resulting fire regimes have differing levels of expected fire behavior and frequency (see table 25). Due to dramatically increased fire return intervals, most ecological response units with known fire history are highly departed from reference conditions. Mixed Conifer with Aspen and Pinon Juniper Evergreen Shrub are considered moderately departed with moderate risk due to fire return intervals being similar to reference conditions, but a shift towards mostly non-lethal severity. Currently, the Cibola National Forest contains uncharacteristically dense forests with many more young trees than were present historically (see the “Vegetation” section). These stands are at high risk for uncharacteristic wildfires due to the accumulated buildup of live and dead fuels, as well as increased canopy density and fuel continuity. As a result, the likelihood of fires threatening homes and communities, causing high tree mortality, and degrading watersheds is increasing as well.

Table 25. Fire return interval for Cibola National Forest ecological response units

Ecological Response Unit	Severity class	Cibola (actual)	Reference Low	Reference High
Chihuahuan Desert Scrub	Mixed severity	Unknown	No fire	>200
Chihuahuan Salt Desert Scrub	Mixed severity	Unknown	100	200
Colorado Plateau / Great Basin Grassland	Non-lethal	6,298	No fire	No fire
Colorado Plateau / Great Basin Grassland	Mixed severity	73,613	No fire	No fire
Colorado Plateau / Great Basin Grassland	Stand-replacing	0	0	35
Colorado Plateau / Great Basin Grassland Total	NA	5,801	NA	NA
Gambel Oak Shrubland	Non-lethal	414	No fire	No fire
Gambel Oak Shrubland	Mixed severity	3,646	No fire	No fire

Ecological Response Unit	Severity class	Cibola (actual)	Reference Low	Reference High
Gambel Oak Shrubland	Stand-replacing	23,742	35	200
Gambel Oak Shrubland Total	NA	366	No fire	No fire
Intermountain Salt Scrub	Mixed severity	Unknown	35	>200
Juniper Grass	Non-lethal	147,515	No fire	No fire
Juniper Grass Total	NA	147,515	0	35
Mixed Conifer - Frequent Fire	Non-lethal	169	9	22
Mixed Conifer - Frequent Fire	Mixed severity	504	9	22
Mixed Conifer - Frequent Fire	Stand-replacing	856	No fire	No fire
Mixed Conifer - Frequent Fire Total	NA	110	NA	NA
Mixed Conifer w/ Aspen	Non-lethal	217	No fire	No fire
Mixed Conifer w/ Aspen	Mixed severity	354	50	100
Mixed Conifer w/ Aspen	Stand-replacing	401	50	100
Mixed Conifer w/ Aspen Total	NA	101	NA	NA
Mountain Mahogany Mixed Shrubland	Non-lethal	759	No fire	No fire
Mountain Mahogany Mixed Shrubland	Mixed severity	10,093	No fire	No fire
Mountain Mahogany Mixed Shrubland	Stand-replacing	1,254,762	35	200
Mountain Mahogany Mixed Shrubland Total	NA	705	NA	NA
Madrean Pinyon-Oak Woodland	Mixed severity	NA	35	>200
Madrean Pinyon-Oak Woodland	Unknown	14,873	No fire	No fire
Montane / Subalpine Grassland	Non-lethal	7,037	No fire	No fire
Montane / Subalpine Grassland	Mixed severity	91,184	No fire	No fire
Montane / Subalpine Grassland	Stand-replacing	3,326,852	0	35
Montane / Subalpine Grassland Total	NA	6,520	NA	NA
Pinon Juniper Evergreen Shrub	Non-lethal	203	No fire	No fire
Pinon Juniper Evergreen Shrub	Mixed severity	2,358	35	200

* Cibola (actual) fire return interval is the inverse of an ecological response units proportional area that burned from 1984 to 2010 (annual average); data from Monitoring Trends in Burn Severity website <http://www.mtbs.gov>). No fire means no fire occurrence. Reference conditions from LANDFIRE 2010 and TNC 2006 as adapted in Wahlberg et al. 2013.

Cibola Wildfire History

From 1970 to 2012, there were 4,245 wildfires that burned 115,494 acres within the Cibola fire protection area (figure 6). The fire protection area includes all land within one mile of the Cibola administrative boundary. Except for the heavily visited Sandia Ranger District, most wildfires within the Cibola fire protection area have been ignited by lightning.

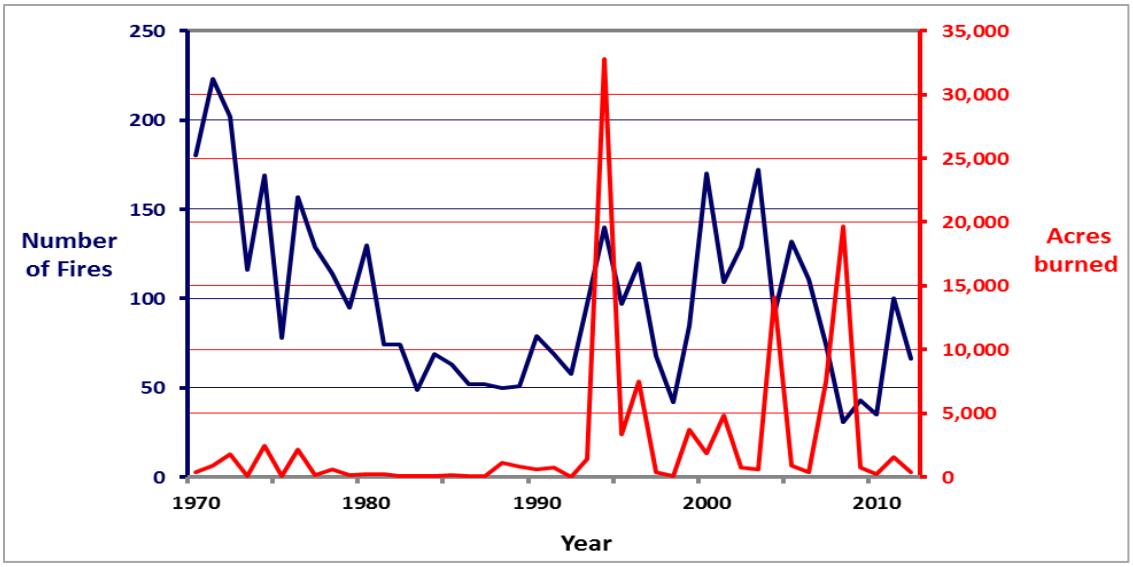


Figure 6. Wildfire occurrence within the Cibola fire protection area from 1970 to 2012 (FAMWEB 2013)

The Wildland-Urban Interface

The wildland-urban interface is defined as resident populations at imminent risk from wildfire, and human developments having special significance. These areas may include critical communications sites, municipal watersheds, high voltage transmission lines, observatories, church camps, scout camps, research facilities, and other structures that if destroyed by fire, would result in hardship to communities. These areas encompass not only the sites themselves but also the continuous slopes and fuels that lead directly to the sites, regardless of the distance involved. This has become a complicating factor related to fire management in the Cibola, as there have been an increased number of people living within and next to the forest. Many urban subdivisions are being situated close to forested areas for their aesthetic and economic values. This translates into demands by the public for increased efforts by the Cibola that address fuels and fire management and wildfire suppression in these interface areas.

Headwaters Economics (2017) estimated the total area of wildland-urban interface for all of New Mexico and provides information specific to the Cibola.

- **Magdalena Ranger District** aggregate county region has 78 square miles of land classified as wildland-urban interface, with 5 square miles developed for residential use.
- **Mt. Taylor Ranger District** aggregate planning area has a total of 82 square miles of wildland-urban interface, with 9 square miles developed for residential use.
- **Mountainair Ranger District** has 62 square miles with 17 developed for residential use.
- **Sandia Ranger District** has 49 square miles of wildland-urban interface with 12 square miles developed for residential use.

Residential development has dramatically increased adjacent to Cibola National Forest boundaries and prompted the adjacent at-risk communities in the wildland-urban interface to respond to the threat of wildfire by developing community wildfire protection plans. Community wildfire protection plans are developed by communities in response to the Healthy Forests Restoration Act of 2003. The act requires Federal agencies to collaborate with communities in developing hazardous fuel reduction projects and places priority on treatment areas identified by communities through the development of a community wildfire protection plan. A primary objective of a community wildfire protection plan is to help local governments, fire departments and districts, and residents identify at-risk public and private lands to better protect those lands from severe wildfire threat. Additional functions of a community wildfire protection plan are to improve fire prevention and suppression activities, as well as to identify funding needs and opportunities to reduce the risk of wildland fire and enhance public and firefighter safety. Identifying at-risk areas and improving fire protection capabilities helps communities prioritize projects and expedites overall project planning. These were developed in partnership with both New Mexico State Forestry and the Cibola National Forest. Table 26 displays the community wildfire protection plans under the influence of Cibola fire management and the areas contained therein.

Table 26. Community wildfire protection plans and estimates of wildland-urban interface area in the Cibola area of influence

Ranger District	Counties in Area of Influence	Square Miles of Wildland-Urban Interface within County*	Community Wildfire Protection Plans in Place that Include the Cibola National Forest
Mt. Taylor	Cibola	31	Candy Kitchen
Mt. Taylor	McKinley	11	Candy Kitchen
Mt. Taylor	Sandoval	40	Middle Rio Grande
Magdalena	Catron	31	Datil
Magdalena	Socorro	19	Middle Rio Grande and Claunch-Pinto
Magdalena	Sierra	28	None
Mountainair	Lincoln	40	Claunch-Pinto
Mountainair	Torrance	11	Claunch-Pinto
Mountainair	Valencia	3	Middle Rio Grande
Mountainair	Bernalillo	9	Not applicable
Sandia	Bernalillo	9	East Mountain and Middle Rio Grande
Sandia	Sandoval	40	Middle Rio Grande

*May include wildland-urban interface areas not adjacent to the Cibola but to other Federal ownerships. Sources: Headwaters Economics (2017) and New Mexico State Forestry Division (2013).

A principal reason for the escalating cost of wildland fire in the U.S. and the Cibola specifically is the increase in development adjacent to or near public lands. The continued development of residential areas in and adjacent to the Cibola boundaries has an increasing influence on fire suppression strategies and tactics for all firefighting resources. The increase in complexity due to these developments is expected to continue into the foreseeable future.

Environmental Consequences

The environmental consequences in this section focus on the components of wildland-urban interface and fire management that are useful to the decision maker and the public. Analysis is based upon the changes to administrative controls and the potential number of acres treated annually that would trend the Cibola towards the desired condition related to fire regime condition class.

Indicators

- Change in fire effects resulting in the loss of key ecological attributes that define a particular ecosystem
- Ability to implement effective fuels treatments in the wildland-urban interface

Assumptions for Fires and Fuels

- A standard would be developed for all alternatives that would require that implementing unplanned ignitions would require documentation of resource objectives and protection.
- All ignitions would be subject to directives in Forest Service Manual 5140 – Hazardous Fuels Management and Prescribed Fire.
- Current use of fire regime condition class will continue in conjunction with appropriate documentation in the wildland fire decision support system or similar risk assessment process will be utilized to determine the appropriate management response.
- Fire regime condition classifications are utilized to determine that acres proposed for treatment will meet the need to reduce the loss of key ecosystem attributes.

Environmental Consequences Common to All Alternatives

Under all alternatives, prescribed fire, mechanical treatments, and naturally ignited fires would be utilized to reduce the threat to the wildland-urban interface and reduce adverse fire effects. These treatments in fire-adapted ecosystems would move the Cibola towards the desired condition at varying levels depending on the scale of proposed treatments; the ecological conditions; and on the seasonality, severity, and extent of the fire.

Beneficial effects from fire consist of the acceleration of nutrient cycling, an increase in soil fertility, and improved plant productivity. Short-term effects of fire include the removal of vegetation that subsequently increases soil erosion and sedimentation. When fire severity is high, it can create water-repellent soils that then decrease water infiltration, which may result in flash flooding events that can be a public and user safety hazard downstream.

Environmental Consequences – Alternative A

The no-action alternative does not make any changes to the existing plan. As such fire management issues and conditions would be expected to continue much as they have in the past. Under alternative A, 2,000 to 5,000 acres per year would be mechanically treated in highly departed areas. These treatments in fire-adapted ecosystems would reduce the number of acres susceptible to adverse fire effects such as soil erosion, sedimentation, and flash flooding due to uncharacteristic fires. In addition, 3,500 to 10,000 acres would be prescribed burn to reduce the potential for wildfire risk and the potential for adverse fire effects because of that risk. The ability to focus fuel treatments in the wildland-urban interface would remain as it has. There would be progress made but the rate would not be sufficient to reduce the threat of uncharacteristic wildfire, or to protect communities at the same rate as the action alternatives.

Environmental Consequences Common to Alternatives B, C, and D

All action alternatives would provide a substantial increase in both management-ignited prescribed fire and natural ignitions that can be managed for resource benefits. This would help focus treatments to reduce adverse effects and increase treatments that assist with wildland-urban interface concerns. The increased rate of treatment in ponderosa pine and mixed conifer would increase the rate toward the desired conditions of open stand structure as noted in the "Vegetation" section under "Affected Environment". The more open canopy would break up continuous live fuels and promote surface fire behavior, which would reduce the risk for high-severity wildfires, particularly in the wildland-urban interface areas.

In fire-adapted forests, the reduction of ladder fuels promotes low-intensity wildland fire. Increased management of low-intensity wildland fire, both prescribed fire and managed wildfires, would trend a larger percentage of the area towards the historic fire regime, increase the areas resilient to disturbance, enhance and maintain stand structure, and facilitate fire suppression. Due to the proposed mechanical treatments and prescribed burning in varying scale and intensity across all of the alternatives, the risk of uncharacteristic high-severity, stand-replacing crown fires would be reduced. As well, reduced patch-size would limit the areal extent of fires and result in less contiguous fuels in all vegetation types.

The proposed action and alternatives B and D provide wildland-urban interface guidance specific to the vegetation communities. For each vegetation community, treatments in the wildland-urban interface would create vegetation structure, composition, and fuel loadings that support low-intensity surface fire to reduce the impacts of wildfire on communities by facilitating effective fire suppression as well as reducing post-fire effects. Although the no-action alternative does not contain plan components that specifically address treatments in the wildland-urban interface, management would be similar to that of the action alternatives.

Environmental Consequences – Alternative B

This alternative includes plan direction to focus actions on site-specific management areas. Fire effects would be similar to alternative A with improved plan components that take a holistic approach to fire and fuels management.

Alternative B would treat 2,000 to 5,000 acres annually with mechanical treatments. Alternative B would also complete 4,200 to 12,000 acres annually of prescribed burning, with the potential to manage wildfire for beneficial effects on an additional 2,200 to 5,500 acres per year. This mix of mechanical treatments and prescribed burns would provide for resilient ecosystems by reducing the potential for uncharacteristic wildfire. This alternative would result in a decrease in departure of vegetative conditions as noted in the vegetation environmental effects section as compared to alternative A. This is a result of decreased fire severity over a larger area. This alternative takes a more aggressive approach to reducing fire behavior and would thus move more acres to lower fire hazard more quickly than alternative A but would be somewhat less effective than the combined mechanical and prescribed fire treatments that are more focused in alternative C.

The proposed amount of mechanical treatments would remain the same as in alternative A, but the amount of prescribed burning would increase by 20 percent from alternative A. This increased amount of prescribed fire would reduce the risk of uncharacteristic high-severity, stand-replacing crown fires, reduce patch-sizes, and result in less contiguous fuel source across all vegetation types. However, treatments under alternative B are not likely to be as intensive as those in alternative C. This could result in more areas susceptible to uncharacteristic wildfire events.

Fuels treatments in wildland-urban interface areas would be increased under alternative B which would in turn reduce the effects of uncharacteristic wildfire such as vegetation removal, soil erosion and sedimentation, and flash flooding. The increased treatment in the wildland-urban interface areas would also address the treatment goals of local community wildfire protection plans with the Cibola's cooperators.

Environmental Consequences – Alternative C

Alternative C was developed to emphasize restoration and partnerships by increasing the intensity of restoration treatments. High-use areas from the public, such as interface areas around communities and roadways, are emphasized for proposed management. This alternative is similar to alternative B, except it creates larger management areas (called restoration management areas) which place an emphasis on intensive management across multiple resource areas. Restoration methods are focused on mechanical thinning to reduce fire hazard and protect infrastructure. This alternative has the greatest amount of stewardship project opportunities for increasing amounts of mechanical fuel reduction.

The objectives in this alternative increase treatment acres for mechanical thinning and prescribed burn when compared to the other alternatives. Fire effects would be moderated and controlled to a greater extent through the increase of prescribed fire focused on supporting the mechanical treatments. The amount of treatment is increased to 2,800 to 7,000 acres a year mechanically (40 percent increase above other alternatives), 4,900 to 14,000 acres with prescribed burning (40 percent increase above the baseline - alternative A), and 2,400 to 6,000 acres through naturally ignited wildfires on an annual basis (20 percent increase from alternative A, slightly less than alternative B and D). This increase in mechanical thinning and prescribed burning would reduce the risk of uncharacteristic high-severity wildfire which in turn would reduce soil erosion, sedimentation, and the chance of flash flooding following uncharacteristic fire events.

The increased intensity of treatments in alternative C would increase the number of acres treated, therefore reducing fuel loading and associated fire hazard as well as adverse ecological effects. Much of the focus of the marked increase in prescribed fire following mechanical treatment under this alternative would be in wildland-urban interface areas as compared to alternative A. The effectiveness of these treatments would result in reduced risk of uncharacteristic wildfire events.

Environmental Consequences – Alternative D

Alternative D decreases the intensity of restoration treatments. This alternative accepts larger risk across larger areas, such as allowing for more managed fire. Alternative D recommends the most wilderness acres of all alternatives. This alternative prescribes less intensive management. The emphasis of natural ignitions playing a bigger role in ecosystems at the landscape level is greater than under the other alternatives. As a result, larger areas have the potential to trend toward the desired condition and function.

This alternative provides for the same range of prescribed fire and managing natural ignitions as alternative B. The range of mechanical treatment acreage is the same as alternatives A and B. Fire effects would be moderated under this alternative which would result in a decrease in stand-reduction fire.

Because of increased prescribed fire acres (20 percent increase over alternative A), the Cibola personnel may be able to focus fuels treatments in the wildland-urban interface more than alternative A. This increases the ability of the Cibola to work with cooperators in incorporating local concerns documented in local community wildfire protection plans. In general, the increase in acres treated can be a benefit; however, treatments under this alternative are not likely to be as intensive as those in alternative C. This could result in more areas susceptible to uncharacteristic wildfire events.

Since alternative D recommends the most acreage of wilderness, the limitation on vegetation treatments due to the restricted use of mechanized and motorized equipment can increase the risk of uncharacteristic wildfire in the recommended wilderness and surrounding area. Many of these recommended wilderness areas lack recent mechanized and motorized vegetation treatments, which may result in more departed conditions than the vegetation community forestwide. As a result, vegetation conditions in these areas may be more vulnerable to uncharacteristic wildfire events. However, some of the recommended wilderness areas with lower vegetation departure or recent wildfire activity are less likely to need treatment and therefore would be less likely to be vulnerable to uncharacteristic wildfire events.

Cumulative Environmental Consequences

The National Forest System lands managed by Cibola National Forest staff and the adjacent lands are considered the cumulative effects analysis area. In conjunction with the ongoing and foreseeable actions on adjacent lands, the proposed mechanical treatments and prescribed burning will increase fire resiliency across the landscape. The ability to effectively change the potential fire effects for the better and treat in the wildland-urban interface would be enhanced as a result of wildland-urban interface treatments and fuels reduction activities on lands other than National Forest System lands Proposed fire management actions by the Cibola are consistent with, and complementary to those proposed by adjacent communities, tribes and other Federal land managing agencies and would reduce the potential for cumulative effects from uncharacteristic wildfire Many adjacent jurisdictions have prepared community wildfire protection plans are authorized and defined in Title I of the Healthy Forests Restoration Act. Federal and State funding for hazardous fuel reduction projects is provided to counties or community based on signed and approved community wildfire protection plan. Community wildfire protection plans have three main components: collaboration with all stakeholders throughout the community wildfire protection plan process, identification and prioritization of hazardous fuel reduction areas, and addressing the treatment of structural ignitability within the community wildfire protection plan area.

Current and proposed fire management of the Bureau of Land Management lands administered by the Rio Puerco Field Office follow guidance in the fire and fuels resource management plan amendment, the Healthy Forests Restoration Act of 2003, and updated Rio Puerco Field Office fire management plans. The goal of the Bureau of Land Management fire management program is to lower the fire regime condition class within the planning area.

The occurrence of fires in the future is inevitable; however, these wildfires will be affected on a landscape level by the combination of treatments undertaken by various jurisdictions. When taken together, these projects will improve fire suppression effectiveness as future projects are implemented. The treatments adjacent to the forest also would increase management options for use of prescribed fire to reduce fire hazard and adverse ecological damage. Increasing the area treated on the landscape both within the forest boundary and on adjacent lands can also have a beneficial influence on fire behavior outside treated areas (Finney 2001) potentially reducing the spread and intensity of fires. This would then reduce adverse fire effects and enhance fire suppression in the wildland-urban interface as well. As a result, the proposed increase in treatments combined with past, present, and foreseeable future actions by the above jurisdictions would have positive cumulative effects on future wildfire control and fire effects.

Sustainable Rangelands and Livestock Grazing

Livestock grazing contributes to the livelihood of the permittees and to the economy of local communities and counties. Owing to the history of land use and ownership in the region, many contemporary ranchers rely to a considerable degree on public land to graze their animals" (Raish and McSweeney 2003).

Livestock grazing today plays an essential role in providing ecosystem services. Continuing this way of life on ancestral lands enhances the culture and heritage for future generations. Many people living in traditional communities participate in or have connections to ranching and identify with the associated values (cultural ecosystem service). Livestock grazing contributes to the livelihood of permit holders and to the economy of traditional communities and counties (provisioning ecosystem service). Some ecological benefits from livestock grazing include aeration of the soil through hoof action, invasive plant control, reduction of fine fuels (decadent grasses and forbs), maintaining open space off the Cibola National Forest, increased water developments in uplands, and an important source of food and fiber (cultural and provisional ecosystem services).

There is congressional mandate to allow grazing on suitable lands (Multiple Use and Sustained Yield Act of 1960, Forest and Rangeland Renewable Resource Planning Act of 1974, Federal Land Policy and Management Act of 1976, National Forest Management Act of 1976).

Forage-producing National Forest System lands will be managed for livestock grazing and the allotment management plans will be prepared consistent with land management plans (36 CFR 222.2). Unless otherwise specified by the Chief of the Forest Service, all grazing and livestock use on National Forest System lands and on other lands under Forest Service control must be authorized by a grazing or livestock use permit (36 CFR 222.3).

Livestock management on National Forest System lands has shifted to an adaptive management philosophy that allows timely changes in livestock numbers or time to be made in response to changing conditions involving changes in forage production, water availability, and precipitation patterns. As a result, livestock numbers have declined over the last 20 years, because Cibola National Forest personnel have balanced permitted numbers with the capacity of the land while responding to environmental changes such as but not limited to drought and shrub encroachment. Over the last decade, Cibola personnel have worked with partners and permit holders to manage grazing pressure on sensitive areas (for example, critical areas, riparian areas).

Range management on the Cibola National Forest has changed dramatically since the early 1900s. In the early days of the Cibola, grazing was largely unregulated, and the range was typically grazed by cattle, sheep, and horses. During the 1930s, fences began to divide the Cibola into permitted grazing allotments. The peak of grazing was during World War II when Congress demanded as much protein as possible from these rangelands. In the late 1960s and early 1970s, a shift in public attitude regarding the use of public land emerged. Congress passed the National Environmental Protection Act in 1969, directing land managers to address the environmental consequences of activities on Federal lands. As a result of the act, forest management plans were prepared for every national forest administered by the United States Department of Agriculture. The purpose of these management plans was to address the status of national forest resources which included livestock grazing and to develop a solution to meet long-term goals and grazing on National Forest System lands.

Affected Environment

The “Vegetation” and “Fire” sections of this chapter provide information on the conditions and trends of the vegetation environment.

Livestock grazing primarily occurs within the Mount Taylor, Magdalena, and Mountainair Ranger Districts. These districts are made up primarily of high-altitude systems that range in elevation from 6,000 to 12,600 feet.

Since 1992, most range allotments in the analysis area have been through a rigorous evaluation and environmental analyses. Forage production has been matched with permitted livestock numbers. Adaptive management is being used to maintain and improve the rangeland resources.

Cibola National Forest personnel administer a total of 86 active grazing allotments on the Mount Taylor, Magdalena, and Mountainair Ranger Districts on approximately 1,441,761 acres. There are no allotments on the Sandia Ranger District. Seventy-six livestock permittees hold term permits that authorize grazing 16,189 head of cattle. There are no active sheep or goat permits or other classes of livestock on the Cibola. Horse use is considered incidental and associated with active cattle permits. There are currently 5 vacant and 4 closed allotments on the Cibola National Forest.

From 2012 to 2016, there has been an annual average of 46,003 permitted animal unit months and an average of 33,309 authorized animal unit months for the Mount Taylor, Magdalena, and Mountainair Ranger Districts.

Over recent years, particularly since 2012, authorized use has been 28 percent below permitted use, on average (table 27 and figure 7). This has been primarily due to the impacts of drought; however economic conditions have also contributed to this as well. On most of Cibola National Forest, livestock permittees, in coordination with the Cibola staff, have voluntarily reduced their stocking levels which has contributed to overall satisfactory range conditions and providing a clear demonstration of an adaptive management strategy.

Table 27. Permitted animal unit month allocation and authorized use, 2012 through 2016 averages

Average Permitted and Authorized	Animal Unit Months
Average Permitted	46,003
Average Authorized	33,309
Percent Authorized of Permitted	72

NRM IWeb annual grazing statistical forest/grassland reports 2012 to 2016

Allotment grazing periods of use within the planning area vary and include either seasonal or yearlong. Seasons include fall/winter/spring period and spring/summer/fall period. Grazing systems may include rest rotation, deferred rotation, and deferred rest rotation. Allotments that are grazed seasonally include herding of cattle between public land allotments and base property.

On a landscape scale, the current range conditions are considered to be satisfactory on the mountain districts, based on data collected for annual inventory and monitoring to comply with the 1985 plan monitoring requirements. A satisfactory rating is determined when the long-term trend in vegetation and soil conditions is meeting or moving toward the desired ecological condition. This is based on ecological similarity of vegetation and soil conditions to site potential.

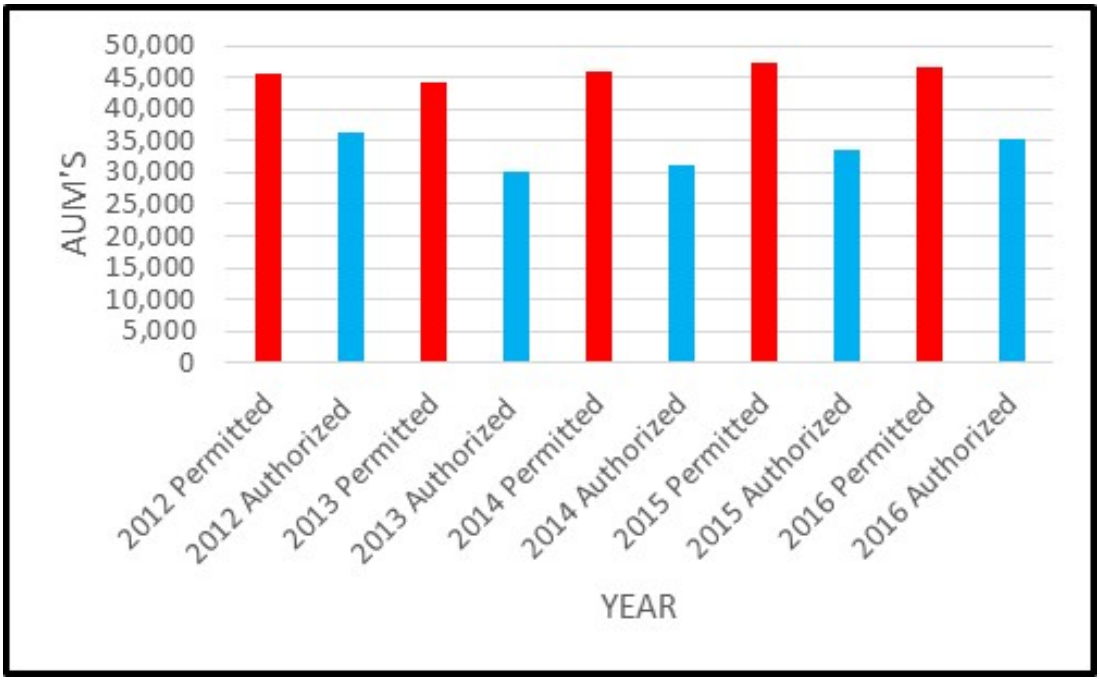


Figure 7. Cibola National Forest 5-year average comparison of permitted verses authorized animal unit months on mountain units

Environmental Consequences

The land management plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carry out any project or activity. Because the land management plan does not authorize or mandate any site-specific projects or activities (including ground-disturbing actions), there can be no direct effects. However, there may be implications, or long-term environmental consequences, of managing the national forests under this programmatic framework. This management action does not change any current activities for range management permitted under the 1985 plan. Additional planning actions would be required to manipulate animal unit months, pasture and allotment boundaries, and the addition or removal of range improvements.

The significant issue associated with livestock grazing relate to cultural uses and values and concern about balancing culturally based traditional uses with nontraditional uses. Indicators used to measure change regarding sustainable rangelands and livestock grazing include:

- changes in forage availability
- increases or decreases in forage production and livestock distribution
- changes in range vegetation improved
- increases or decreases in structural and non-structural range improvements to enhance livestock distribution

The primary issues associated with livestock grazing relate to the potential reductions in the area available for general livestock grazing or for grazing of specific types of livestock in certain areas in the time after treatments that it takes for forage production to increase. These constraints generally relate to restoration of landscapes following fire, protection of habitat for special status species and protection of soil, water, and vegetation.

Additionally, livestock grazing may be affected to lesser degrees on areas remaining available for grazing through competition or conflict with other resource users (for example, mineral development, recreation, and wildlife), or through the need to properly protect other resources such as soils, vegetation, and wildlife habitat. Adjustments in season of grazing, grazing intensity, kind, and class of livestock, or type of grazing system may be necessary in relation to some of these conflicts. The summary of alternatives and the potential effects to livestock and livestock management can be found in table 28.

Table 28. Summary of alternatives and effects to livestock and livestock management.

Alternative	Proposed effects to Livestock or Livestock Management	Measured Change (Average Authorized Animal Unit Months)	Note
Alternative A.	Continuing effects from current management direction would occur. Average authorized animal unit months stay the same and may decrease over time.	33,309	None
Alternative B.	Slightly more effects than alternative A. Average authorized animal unit month increase over time.	33,996 (2% increase)	Some short-term effects are expected as rangelands recover from treatments and livestock may be temporarily removed from existing pastures and allotments; however, long-term effects would be mostly beneficial with the potential increase in forage production.
Alternative C.	Likely to have greater effects than alternative A. Average authorized animal unit month increase over time.	33,996 (2% increase)	As more areas are proposed for treatments in this alternative, the short-term effects may be greater than those in alternatives A and B; however, the long-term effects are anticipated to be more beneficial with the potential increase in forage quality and quantity. Therefore, the long-term effects of this alternative would also be greater (due to beneficial effects) than alternatives A or B.
Alternative D.	Anticipated to have effects greater than alternative A, but less than alternative B and C. Average authorized animal unit months stay the same and may decrease over time.	33,309	This alternative proposes the least amount of treatments; therefore, the short- and long-term effects would be greater than alternative A but less than alternative B and C.

Assumptions for Analysis

- Market demands for livestock products are highly variable. It is assumed that current market demands for livestock products would continue throughout the next several decades with a continuing demand for grazing of the National Forest System lands.
- Livestock grazing use would be authorized dependent on forage availability.
- The New Mexico Department of Game and Fish manage populations of big game (mule deer, elk, pronghorn, and bighorn sheep).

Interactions with Other Programs

Livestock grazing and operations on the Cibola National Forest could potentially be affected by other Forest Service activities and decisions and permitted uses such as vegetation treatments, prescribed burning, recreation, lands exchange, noxious and invasive weed management, and special designations.

Environmental Consequences Common to All Alternatives

All alternatives would continue to provide continued availability of forage for domestic livestock and opportunities for ranching lifestyles consistent with the other desired conditions.

Livestock grazing under all alternatives would be managed with adaptive management to match livestock numbers with annual forage production. Cibola National Forest personnel would continue to manage grazing to maintain satisfactory range conditions which would provide for native plant communities that support diverse age classes of shrubs, and vigorous, diverse, self-sustaining understories of grasses and forbs relative to site potential, while providing forage for livestock and wildlife.

All alternatives would use adaptive management to address climate change, but climate change is specifically addressed in the action alternatives. Climate change is expected to affect forage conditions. Effects may increase or decrease forage availability and change the composition of available forage. This in turn require adjustment of livestock numbers to compensate for lost forage and changes in livestock distribution. The adaptive management used in allotment management planning allows for adjustments in the number of livestock and season of use so that livestock use matches forage production throughout the grazing season. The Forest Service has regional and forest direction of use of rangelands after drought to ensure the health of forage resources.

The impacts of livestock grazing to riparian habitat at wetlands and springs would be analyzed in all new range projects on the Cibola. If substantial negative effects such as trampling, and over utilization of riparian vegetation, cannot be mitigated through grazing management practices (herding and grazing deferment when the areas are wet), then livestock exclosures may be necessary. These exclosure areas would likely not be available for forage but are not big enough to reduce stocking rates in a pasture. The use of water by livestock at these exclosures is mitigated with alternative water sources, including wells, or by providing lanes to the water, or piped to a livestock drinker.

Under all alternatives, dispersed recreation, firewood gathering, wildfires, roads, off-highway vehicle use, and elk grazing can also affect the forage resources. Impacts could include damage to herbaceous vegetation, and displacement of livestock from suitable rangelands as a result of human activity. The intensity of these effects varies throughout the forest depending on the intensity of these activities. When conflicts arise from these uses that threaten the long-term condition and trend of forage resources, Cibola personnel will look for multiple-use solutions that properly balance these effects.

Environmental Consequences – Alternative A

Since the inception of the 1985 plan, there have been numerous changes within the boundaries of the Cibola National Forest. These changes have come primarily in the form of population increases in the communities within and surrounding the Cibola. A direct result of the increasing population has been a substantial increase in recreational use of the Cibola lands, especially off-road vehicle use. This has created conflicts with livestock grazing. Due to population encroachment from communities, livestock grazing systems and rotations have been adjusted to compensate for the increased demand and general public interactions with livestock and livestock improvements. Increased off-highway vehicle and recreational uses, such as camping, hunting, and hiking, have resulted in additional disturbances. Examples include trampling and disturbance of rangelands, vandalism of range improvements, and disruption in management including opening of pasture gates, or cut fences.

Management of watersheds, and water quality and quantity would continue in accordance with direction in the 1985 plan (as amended). The 1985 plan does not provide clear direction, including desired condition or plan objectives, to maintain or restore watersheds toward desired condition of properly functioning. The potential effects associated with this lack of clear direction on watershed restoration results in impairment of watersheds and degradation of water resources, which in turn, impairs rangeland health and forage availability.

Allotment rangeland evaluations are regularly being completed primarily in conjunction with grazing term permit renewals to determine if actions relating to livestock grazing are maintaining or progressing toward desired conditions and other relevant resource objectives.

Change in Forage Availability

Under alternative A, the potential impacts to the change in forage availability for domestic livestock and livestock distribution is twofold. Forage production would remain static and decrease over time due to an increase of tree and shrub density from maintaining the current level of mechanical and prescribed fire treatments on vegetation. Livestock distribution would also remain static or decrease, resulting in declining vigor and abundance of herbaceous vegetation.

Changes in Range Vegetation Improved

The number of structural and non-structural range improvements would be expected to remain the same and or decrease over time. As a result, changes in livestock distribution and improvements to the vigor and abundance of herbaceous vegetative conditions attributed to the quality and quantity of range improvements would decrease.

Conclusion

Approximately 1.4 million acres would remain open to grazing, grazing would continue to be authorized on grazing allotments that have been determined to be meeting or progressing toward achievement of standards for rangeland health. The reduction in acres treated under vegetation and fire management would continue to reduce available acres for livestock due to reduced availability of an herbaceous component in the wooded areas.

Environmental Consequences – Alternative B

Under this alternative, the incorporation of forestwide desired conditions addresses cultural uses and value issues relating to the authorization of grazing on approximately 1.46 million acres within the Cibola National Forest planning area. This is expected to meet the proposed revised plan goals and objectives. Additional vegetation treatments may result in an overall increase of forage quantity, quality, and increased partnerships could result in additional range infrastructure and capacity to maintain and repair existing range improvements. This would lead to better livestock utilization of range resources and improvements to rangeland health. The additional areas slated for vegetation treatment would result in slightly greater short term impacts than those in alternative A. More acres would be temporarily be unavailable for utilization by livestock directly after mechanical and prescribed fire treatments than in alternative A. However the long-term effects are expected to be greater post treatment due to more areas restored to early successional states. These early successional states would contain more grassland and shrub dominated areas, with little or no overstories and would result in greater quantity and quality of forage production. Over the long term, such changes would continue to meet range desired conditions and other resource objectives.

There would be a slight increase of two percent in average authorized animal unit months (see table 28) to 33,996 animal unit months in alternative B. The proposed range plan direction with a management approach that considers the re-opening of historically closed allotments such as, but limited to, Gross Kelly, La Madera, and Carnuel that would add approximately 2 percent of average authorized animal unit months to the total amount on the Cibola. In addition, this emphasis on partnerships should facilitate deferred maintenance of existing range projects and the development of new range projects.

Change in Forage Availability

Under alternative B, the potential impacts to the change in forage availability for domestic livestock and livestock distribution is twofold. Forage production would be anticipated to increase in the long term as a result of increased levels of mechanical and prescription fire treatments on vegetation. Livestock distribution would improve and would result in improved vigor and abundance of herbaceous vegetative conditions.

Changes in Range Vegetation Improved

This alternative will slightly increase the likelihood that additional structural and nonstructural range improvements will be permitted as part of this alternative. An increase to the quality and quantity of range improvements can further increase livestock distribution, which would result in improved vigor and abundance of herbaceous vegetation conditions. However, the increase in wilderness designation may limit access to maintain or repair existing structural range improvements or the construction of new structural range improvements in these management areas. The inability to repair range improvements in these areas could negatively impact livestock distribution in these areas and lead to overutilization of herbaceous vegetation.

Conclusion

Approximately 1.4 million acres would remain available for livestock grazing. Animal unit months would be authorized based on an allotment by allotment evaluation. Livestock grazing would be authorized on grazing allotments that have been determined to be meeting or progressing toward desired conditions. Landscape vegetation treatments could temporarily affect access to grazing; however, expected long-term increases to forage production would enhance livestock distribution and forage availability. The draft land management plan would achieve the stated desired conditions for this resource.

Environmental Consequences – Alternative C

Alternative C was developed to emphasize restoration and partnerships by increasing the intensity of restoration treatments. In alternative C, the highest need for restoration, in terms of the highest ecological risk, overlaps with the highest risk of management. Management focus would be on existing landscape-based restoration projects. This alternative is similar to alternative B except it creates larger management areas (called restoration management areas) which place an emphasis on intensive management across multiple resource areas. Restoration methods are focused on mechanical thinning to reduce fire hazard and protect infrastructure and fuelwood collection is widely available. These broad-based management areas have their own desired conditions, objectives, and management approaches, prioritizing work and partnerships.

Impacts to livestock grazing management and operations from this alternative would be similar in nature to those outlined in alternative B but to a greater extent. The additional areas slated for treatment would result in slightly greater short-term impacts than those in alternative B as larger areas would be treated with both mechanical and prescribed fire treatments. More acres would be temporarily unavailable for utilization by livestock directly after mechanical and prescribed fire treatments than in alternative B. These large scale landscape scale restoration projects would result in further restoration of rangelands and increases in forage availability. Similar to alternative B, however to a greater extent, the potential long-term effects are expected to be greater post treatment due to more areas restored to early successional states. These early successional states would contain more grassland- and shrub-dominated areas, with little or no overstories and would result in greater quantity and quality of forage production.

Similar to alternative B, there would be a slight increase of 2 percent in average authorized animal unit months (see table 28) to 33,996 animal unit months in alternative C due to the potential addition of historically closed allotments. The proposed range plan direction with a management approach that considers the re-opening of historically closed allotments would add approximately two percent of average authorized animal unit months to the total amount on the Cibola.

The decrease of recommended wilderness from 55,779 acres in alternative B to 24,265 acres in alternative C would allow increased access for maintenance and reconstruction of existing structural improvements and the construction of new structural improvements. Additional structural improvements would enhance livestock distribution and overall forage availability.

Change in Forage Availability

Under alternative C, the potential impacts to the change in forage availability for domestic livestock and livestock distribution is twofold. Forage production would be anticipated to increase substantially in the long-term as a result of increased levels of mechanical and prescription fire treatments on vegetation. Livestock distribution would improve substantially and would result in improved vigor and abundance of herbaceous vegetative conditions. In addition, the emphasis of partnerships would allow for increased implementation of projects with multiple objectives.

Changes in Range Vegetation Improved

This alternative would moderately increase the likelihood that additional structural and nonstructural range improvements would be permitted as part of this alternative as a result of increased partnerships. In addition, the decrease of recommended wilderness would allow for increased access to maintain and reconstruct existing structural improvements and the construction of new structural improvements. An increase to the quality and quantity of range improvements can further increase livestock distribution, which would result in improved vigor and abundance of herbaceous vegetation conditions.

Conclusion

Approximately 1.4 million acres would remain available for livestock grazing. Animal unit months would be authorized based on an allotment by allotment evaluation. Livestock grazing would be authorized on grazing allotments that have been determined to be meeting or progressing toward desired conditions. Landscape vegetation treatments could temporarily affect access to grazing, however expected increases to forage production would enhance livestock distribution and forage availability. The impacts to range and rangeland resources would be greater than the effects outlined in alternative B and would have the most effects of any of the alternatives. The draft land management plan would achieve the stated desired conditions for this resource.

Environmental Consequences – Alternative D

Alternative D emphasizes backcountry and primitive recreation by decreasing the intensity of restoration treatments. This alternative accepts larger risk across larger areas, such as allowing more managed fire. Alternative D includes the most area of recommended wilderness of all the alternatives.

Impacts to livestock grazing management and operations from this alternative would be similar to those outlined in alternative B, however different in nature. Allowing additional managed fires would result in more areas restored to early successional states with more grassland- and shrub-dominated areas. These areas would have little or no overstories and would result in greater quantity and quality of forage production. However, the increase of recommended wilderness to 203,117 acres in alternative D—greater than a threefold increase—would limit access for maintenance and reconstruction of existing structural improvements and the construction of new structural improvements The effects of the potential disrepair of range improvements and the ability to construct new improvements could negatively impact livestock distribution in these areas and is much more significant than what is identified under alternative B or alternative C.

Whereas the proposed range plan direction with a management approach that considers the re-opening of historically closed allotments still carry forward under alternative D, the increase in recommended wilderness areas, if designated by Congress, would result in decreased access and accessibility to existing range infrastructure, as aforementioned. Due to this consideration, the average authorized animal unit months stay stable with current levels at 33,309 and could potentially decrease over time if the proposed recommended wilderness areas were designated in the life of the plan.

Change in Forage Availability

Under alternative D, the potential impacts to the change in forage availability for domestic livestock and livestock distribution is twofold. Forage production would be anticipated to increase substantially in the long-term as a result of the possibility of larger landscape managed fires. Livestock distribution would improve substantially and would result in improved vigor and abundance of herbaceous vegetative conditions.

Changes in Range Vegetation Improved

This alternative would slightly increase the likelihood that additional structural and nonstructural range improvements would be permitted as part of this alternative. An increase to the quality and quantity of range improvements could further increase livestock distribution, which would result in improved vigor and abundance of herbaceous vegetative conditions. However, the increase of potential wilderness designation would more than likely result in limited access to maintain or repair existing structural range improvements or the construction of new structural range improvements in these management areas.

Conclusion

Approximately 1.4 million acres would remain available for livestock grazing. Animal unit months would be authorized based on an allotment by allotment evaluation. Livestock grazing would be authorized on grazing allotments that have been determined to be meeting or progressing toward desired conditions. Large landscape scale fires could temporarily affect access to grazing; however, expected increases to forage production would enhance livestock distribution and forage availability. The draft land management plan would achieve the stated desired conditions for this resource.

Cumulative Environmental Consequences

The cumulative environmental consequences for a programmatic land management plan also consider lands managed by other entities in the area and describe the relative contribution of the land management plan decision when considering surrounding landscape with other similarly scaled planning efforts and opportunities.

The timeframe for these combined effects is 10 years in the future because changes in condition and trend in the vegetation depend on the presence of favorable growing conditions after cattle leave the pasture. If growing conditions are favorable, plant height and canopy cover would completely recover within 1 year. If growing conditions are not favorable, plant recovery would occur more slowly (up to 2 to 3 years). Vegetation recovery from the other activities and natural events may take this long, depending on climate.

The cumulative effects area off the Cibola National Forest is primarily private, State of New Mexico, Bureau of Land Management, Navajo Tribe, Zuni Tribe, and National Park Service. Livestock grazing occurs in these areas. Private lands outside of communities typically provide forage for smaller livestock operations but can support larger livestock operators when the private land is in larger blocks. These larger private blocks of lands are typically used for winter grazing during times when permitted livestock are off the Cibola National Forest. State lands are also typically used for winter grazing of the Cibola's permitted livestock. The Bureau of Land Management has both year-round grazing and winter grazing. Navajo and Zuni Tribes graze cattle and horses on their lands, which are owned by individual tribal members. There are no indications livestock use in these areas is going to change much over the next 10 years.

Vegetation treatments, primarily burning and thinning of trees, would occur on these other lands. These types of treatments would increase forage for livestock and improve rangeland conditions in these areas. Under the action alternatives vegetation treatments would complement those occurring outside jurisdictional boundaries of the Cibola and would increase available livestock forage and would generally improve rangelands.

Livestock grazing under the action alternatives would provide for continued availability of forage for domestic livestock and opportunities for ranching lifestyles consistent with the other desired conditions in the plan. Because an adaptive management strategy is used to adjust use with capacity and minimize any adverse effects to rangeland resources, the cumulative consequences associated with continued grazing use are inconsequential. The expected relative significance of the implementation of the action alternatives' plan decisions within the context of the greater landscape would be a slight increase in available forage with no measurable cumulative consequences to other resources and continued opportunities to graze livestock within the planning area.

Sustainable Forestry and Forest Products

Background

From 1985 to 1996, the Cibola National Forest had an active timber sale program. Most activity occurred on the Mount Taylor Ranger District, while the other ranger districts had active fuelwood programs with occasional small sales. The two main mills that utilized Cibola timber resources went out of business in the mid- to late 1990s due to a decade of down-scaling of forest product industries across the Southwest. In September 1996, the 1985 plan was amended to incorporate regional guidance for northern goshawk habitat and Mexican spotted owl recovery. As a result, the Cibola shifted emphasis from producing and selling timber products to wildlife habitat management and restoration. Consequently, the Cibola forestry program drastically declined in staffing, outputs, and accomplishments. It was not until 2002 that the Cibola revamped and restaffed its forestry program. The mandate of the new forestry program was to integrate with the wildlife, watershed, and fuels management programs.

From 2002 to 2008, the nature of timber management revolved around fuel reduction in the wildland-urban interface and other areas. Since 2008, the nature of timber management has primarily revolved around forest ecosystem restoration which includes improving forest health, watershed condition, and wildlife habitat while reducing fuels and providing wood products to local communities. Cibola forestry projects (timber sales, commercial and personal use fuelwood sales, stewardship contracts and agreements) sold an annual average of 16,645 hundred cubic feet between 2003 and 2012. Firewood sales (personal and commercial) accounted for about two thirds of the volume sold.

Since its 2002 restructuring, the Cibola forestry program has become fully integrated with the other vegetation management programs in all aspects such as planning, environmental compliance, and project implementation. There has not been a project developed for the sole objective of conducting a timber sale to provide material to a local mill. In fact, wood products have become collateral outputs of restoration projects, and small wood-processing facilities have been established to take predominantly small-diameter woody material from the projects. These fledgling businesses are unable to pay premium prices for the material due to the economic downturn of 2008 (and slow recovery) as well as their need to make large capital investments in manufacturing equipment. This has required most of the restoration projects since 2008 on the Cibola to have some level of implementation subsidy to meet management objectives. Currently the Cibola pays for on-the-ground treatment either through stewardship authorities or by using service contracts. The wood from these projects is then sold at base rates as firewood or to the fledgling businesses for manufacture into fuel pellets, rough-cut lumber, pallets, firewood, or chips for playgrounds and landscaping material.

Goals

The removal of wood products is designed to meet desired conditions by achieving a distribution of tree size classes and openings. The distribution of size classes and openings reduces the risk of uncharacteristically severe wildfire, improves wildlife habitat, and provides resistance and resilience to the potentially negative effects of system drivers and stressors (insects and disease, uncharacteristic wildfire, climate change). For example, by thinning overstocked stands to mimic historical distributions, more soil water is available to the remaining trees, allowing them to better withstand drought and insect attack—trees need water to produce the resin exuded to “pitch out” bark-boring beetles. Furthermore, lower stand densities may also retard the spread of dwarf mistletoe.

While timber management has the potential to improve forest resistance and resilience to stressors, it is a relatively slow process, taking 2 to 5 years from the beginning of planning to implementation. Because it does not respond quickly to rising threats, timber management works better as a long-term approach to achieving desired conditions.

Economic Contribution of Timber Management

The supply and demand for timber is driven by regional, national, and global issues. Local drivers are small in scope and scale and generally have inconsequential effects on the overall market for timber and lumber products. Larger issues, such as export demand, housing starts, and home improvement trends drive the supply and demand for timber.

The larger issues described above have little impact on the economic contributions of woody material harvested from the Cibola. Woody material harvested from the Cibola is typically used for posts, poles, latillas, vigas, fuelwood, pellets, and rough-cut dimensional lumber (typically used for pallet production). This material primarily provides local subsistence and livelihood to rural communities, with small quantities being sold across state lines and a portion of the dimensional lumber being sold to Mexico for pallet production. The Cibola contributes $2,771,000 in labor income within the timber program and provides 61 full-time timber harvest and production jobs annually (see "Socioeconomics" section).

Because the cost of project implementation varies due to terrain, soils, wildlife habitat requirements, and roads, it is difficult to produce a forestwide average cost per project. The price for mechanical treatment averages about 600 to 700 dollars per acre; the cost of treating with managed fire is about 100 dollars per acre. It is also difficult to estimate the total cost of these projects when considering the environmental compliance and planning elements. Each project location can vary in planning needs based on the forest type, heritage site density, transportation systems, and objectives, causing overall cost to fluctuate greatly.

Affected Environment

Congress established the Collaborative Forest Landscape Restoration Program (CFLRP) in 2009 to encourage the collaborative, science-based ecosystem restoration of priority forest landscapes. The program uses an "all-lands approach" to forest restoration using close coordination with other landowners to encourage collaborative solutions through landscape-scale operations and to also:

- encourage ecological, economic, and social sustainability;
- leverage local resources with national and private resources;
- facilitate the reduction of wildfire management costs, including through re-establishing natural fire regimes and reducing the risk of uncharacteristic wildfire;
- demonstrate the degree to which various ecological restoration techniques achieve ecological and watershed health objectives; and
- encourage utilization of forest restoration by-products to offset treatment costs, to benefit local rural economies, to and improve forest health.

Since 2001—and with a similar emphasis on a smaller scale—the Collaborative Forest Restoration Program (CFRP) has funded 175 projects including close to 500 partners in planning and implementing collaborative forest restoration and small-diameter utilization projects in 20 counties across New Mexico. These projects have restored over 30,000 acres and created over 700 jobs.

Eleven collaborative restoration projects totaling 137,943 acres are currently taking place on the Cibola, including three projects within in the 210,000-acre Zuni Mountain project on the Mt. Taylor Ranger District. These projects not only reduce fire risk, they also benefit recreation and improve scenery (USDA Forest Service 2015a).

Milling and manufacturing within the plan area has been drastically reduced since the closing of local mills in the 1990s. Very little bidding competition for timber, fuelwood sales, and stewardship contracts has occurred. Similarly, the capacity for logging and restoration services has declined to levels insufficient to accomplish Cibola objectives to reduce the potential of uncharacteristic wildfires and insect and disease outbreaks and to improve wildlife habitat, watershed condition, and overall forest health. However, through the assistance of the Collaborative Forest Restoration Program, Forest Product Laboratory woody biomass utilization grants, and stewardship authority, the Cibola personnel have been able to work with local communities and partners to begin rebuilding manufacturing and restoration businesses that are in the fledgling stages of operating.

As these businesses stabilize, there is an expectation that forest restoration would occur and be maintained at a landscape scale. This would create forest structure and dynamics that are more resilient to insect and disease outbreaks and allow wildfire and prescribed fire effects to be within the natural range of variability. Capacity includes mills from within and adjacent to the plan area (table 29). In addition to the mills, there are numerous small retail fuelwood businesses that procure material from the Cibola.

Table 29. Mills within and adjacent to the plan area

Mill	Location
Mt Taylor Manufacturing, Inc. (within the plan area)	Milan, NM
Pablo Romero (within the plan area)	Manzano, NM
Southwestern Forest Restoration Products (within the plan area)	Magdalena, NM
Alamo Navajo School Board, Inc. (within the plan area)	Alamo, NM
Kellar Logging (adjacent to the plan area)	Ruidoso, NM
TC Connelly (adjacent to the plan area)	Jemez, NM
Roger Tucker, Inc. (adjacent to the plan area)	Jemez, NM

Fuelwood is also gathered for personal use through the issuance of firewood collection permits. Some forest products are collected by Tribes for cultural and traditional uses and practices, while others, like wildings (live plants) and Christmas trees are collected by the general public (table 30).

Table 30. Other forest products provided by the Cibola annually (10-year average)

Forest Product	Annual amount
Posts, poles, vigas	53
Latillas	5
Wildings	30
Tribal collection permits	8
Christmas trees	850

The value of forest products is increasing as public demand for these products is increasing. Ecosystem services related to forest products are stable, but they are at risk because the supporting, regulating, provisioning, and cultural ecosystem services of vegetation are at risk (USDA Forest Service 2015a).

Environmental Consequences

Fuelwood availability, that is, the amount of fuelwood made available to the public through the issuance of fuelwood permits, varies by alternative (table 31). Fuelwood production is a separate metric that refers to the amount of fuelwood produced as a byproduct of mechanical treatment (timber harvest, thinning), which also varies by alternative (table 31). Availability of other forest products—posts, poles, vigas, latillas, wildings, Christmas trees, and forest resources harvested by tribes for cultural and traditional uses and practices—would remain at current levels (table 30) under all alternatives.

Table 31. Summary of proposed forest product-related objectives that vary by alternative

Objective	Alternative A	Alternative B	Alternative C	Alternative D
Cords of fuelwood available annually through the issuance of fuelwood permits	9,000 to 12,000	9,000 to 12,000	12,000 to 15,000	9,000 to 12,000
Annual acres of mechanical treatment	2,000 to 5,000	2,000 to 5,000	2,800 to 7,000	2,000 to 5,000

Table 32. Summary of timber production suitability classification for all alternatives (acres)

Classification	Alternative A	Alternative B	Alternative C	Alternative D
Total National Forest System lands in the plan area	1,617,316	1,617,316	1,617,316	1,617,316
Lands not suitable for timber production due to legal or technical reasons[22]	1,528,913	1,528,913	1,528,913	1,528,913
Lands that may be suitable for timber production	88,403	88,403	88,403	88,403
Lands not suitable for timber production because timber production is not compatible with the desired conditions and objectives established by the plan[23]	NA	NA	NA	NA
Place-based management areas	0	3,393	0	0
Proposed research natural areas	0	0	0	0
Conservation management areas	0	0	659	0
Recommended wilderness areas	0	985	27	6,014
Total	0	4,378	686	6,014
Total lands suitable for timber production[24]	88,403	84,025	87,717	82,389

[22] Excluded from all alternatives: designated wilderness, established research natural areas, military reserves, inventoried roadless areas, slopes greater than 40 percent, nonforested lands (including woodlands), Mexican spotted owl protected activity centers, riparian areas, drainages, springs, and lands with low reforestation potential. Excluded by alternative (where applicable): conservation management areas, recommended wilderness areas, proposed research natural areas, and place-based management areas.

[23] Where not already excluded because of legal or technical reasons (see table 2 in appendix B).

[24] Includes restoration management areas.

Under all alternatives, regulated timber harvest activities shall occur only on those lands classified as suitable for timber production (table 32). Land classified as suitable for timber production is expected to produce timber on an ecologically sustainable, regular harvest schedule (see appendix B for detailed determination of timber suitability.) Management activities (timber harvest, thinning, and prescribed burning) to meet other resource objectives are permitted on lands classified as either suitable or not suitable for timber production. For example, timber harvest may be necessary to enhance habitat for threatened and endangered species or to remove hazard trees in recreation sites.

Production of timber and other wood products, including fuelwood, is influenced by the alternative-specific amounts of mechanical treatment and by the amount of land classified as suitable timber (table 33).[25] Nontimber wood products are produced as a by-product of mechanical treatment. Fuelwood permits allow for the gathering of downed and dead wood that may be naturally occurring or that is made available as by-product of a mechanical thinning project and is not included in the proposed wood output calculations.

Table 33. Summary of proposed wood product output by alternative (annual average over the life of the plan).[26] Values are in millions of cubic feet (rounded to nearest 0.01).

Wood Product	Alt. A	Alt. B	Alt. C	Alt. D
Timber Products				
A. Lands suitable for timber production				
A1. Sawtimber[27]	2.57	2.52	3.37	2.49
A2. Other products[28]	0.50	0.48	0.64	0.48
B. Lands not suitable for timber production				
B1. Sawtimber[29]	0.19	0.19	0.25	0.19
B2. Other products[30]	0.04	0.04	0.05	0.04
C. Projected Timber Sale Quantity (A1+A2+B1+B2)	**3.30**	**3.22**	**4.31**	**3.19**
D. Other Estimated Wood Products				
D1. Softwood fuelwood[31]	0.07	0.08	0.10	0.08
D2. Hardwood fuelwood[32]	0.11	0.10	0.13	0.10
Total Fuelwood	**0.18**	**0.18**	**0.23**	**0.17**
D3. Aspen[33]	0.03	0.03	0.04	0.03
E. Projected Wood Sale Quantity (C+D1+D2)	**3.51**	**3.42**	**4.58**	**3.40**

[25] Effects of mechanical harvest on wood output are reflected in land classified as suitable for timber production and wood sale quantity.
[26] See appendix B for detailed summary of proposed wood output.
[27] Industrial softwood species meeting sawtimber specifications (9 inches or more in diameter at breast height), harvested from lands suitable for timber production.
[28] Industrial softwood species not meeting sawtimber specifications (5 to 9 inches in diameter at breast height), harvested from lands suitable for timber production.
[29] Industrial softwood species meeting sawtimber specifications (9 inches or more in diameter at breast height), harvested from lands not suitable for timber production.
[30] Industrial softwood species not meeting sawtimber specifications (5 to 9 inches in diameter at breast height), harvested from lands not suitable for timber production.
[31] Fuelwood (nonindustrial softwood species 5 inches or more in diameter at breast height).
[32] Fuelwood (other hardwood species 5 inches or more in diameter at breast height).
[33] Aspen (5 inches or more in diameter at breast height) that would be available if harvested. However, aspen is not typically harvested on the Cibola; usually left to enhance wildlife habitat, scenery, and biodiversity.

Assumptions

Conservation management areas and recommended wilderness areas may not be compatible with mechanical harvest of forest resources; however, while this may influence where harvest will likely not occur, its impact is difficult to predict, as there would still be ample area forestwide to meet even the most ambitious harvest objectives under all alternatives.

While the objectives for acres of wildfire managed for resource benefit may vary by alternative, the amount and location of wildfires over the life of the plan cannot be predicted, but it is expected that ample unburned area forestwide would still be available to meet projected availability of forest products.

Indicators

- Fuelwood availability
- Land classified as suitable for timber production
- Wood sale quantity
- Other forest products

The ecological effects of sustainable forestry and mechanical treatment are discussed in more detail in the vegetation and soils sections; the social and economic effects related to forest product availability are discussed in more detail in the socioeconomic resources section.

Environmental Consequences Common to All Alternatives

Harvest levels of other forest products (posts, poles, vigas, latillas, wildings, Christmas trees) and tribal harvesting of forest resources would not vary by alternative. These forest resources would continue to be available at current levels under all alternatives.

Harvest of posts, poles, vigas, and latillas is done in coordination with vegetation management activities and reduces ladder fuels and coarse woody material accumulation, thereby reducing wildfire risk and restoring desirable vegetation structure while providing materials and economic opportunity in construction.

Harvest of Christmas trees, wildings, and forest resources important to tribes for cultural and traditional uses and practices is expected to have minimal ecological impact because of its limited scope; however, the expected social benefits are substantial, both culturally (tribal ceremonies, Christmas celebration) and aesthetically (wildings for home beautification projects).

While the demand for forest products is not expected to vary by alternative, the effects from fuelwood availability, classification of land suitable for timber production, and wood sale quantity all vary by alternative and are addressed in the following section.

Environmental Consequences – Alternative A

Indicator: Fuelwood Availability

The availability of fuelwood would remain at 9,000 to 12,000 cords. The public demand for higher fuelwood availability would not be met; associated social (firewood gathering) and economic (commercial firewood sales, reduced heating costs) benefits would remain at current levels. Accumulations of downed fuel and ladder fuels would continue to contribute to risk of uncharacteristic wildfire.

Indicator: Land Classified as Suitable for Timber Production

Land classified as suitable for timber production would be 88,403 acres, the most of any alternative, as no acreage is removed for place-based management areas, proposed research natural areas, conservation management areas, or recommended wilderness areas (table 32).[34] While being classified as not suitable for timber production does not preclude timber harvest, it also does not mandate a regular harvest schedule or artificial restocking where necessary to ensure continued timber production. Therefore, with no alternative-specific removals of land classified as suitable for timber production, there would not be (relative to the other alternatives) any corresponding decrease in timber-industry confidence in a long-term supply of materials bound for the mills or related timber-industry willingness to invest in capital and personnel.

Indicator: Wood Sale Quantity

Although alternatives A, B, and D have equal amounts of proposed mechanical treatment, current levels of timber volume sold (alternative A) would be slightly higher (table 33) because alternative A has no lands removed because of place-based management areas (alternative B) or recommended wilderness areas (alternatives B and D). Fuelwood volume produced in conjunction with mechanical treatments would be similar to alternatives B and D (table 33). Ecological benefits from wood sales—reducing tree density in overstocked stands (reduced fire risk, reduced vulnerability to climate change) and economic benefits to the timber industry (stability, profits) and its employees (jobs, income)—would remain at current levels. Any harvest-related short-term negative effects on soil are expected to be outweighed by long-term benefits to soil condition.

Environmental Consequences – Alternative B

Indicator: Fuelwood Availability

The availability of fuelwood would remain at 9,000 to 12,000 cords. The public demand for higher fuelwood availability would not be met; associated social (firewood gathering) and economic (commercial firewood sales, reduced heating costs) benefits would remain at current levels. Accumulations of downed fuel and ladder fuels would continue to contribute to risk of uncharacteristic wildfire.

Indicator: Land Classified as Suitable for Timber Production

Land classified as suitable for timber production would decrease by 5 percent because of acreage removed for place-based management areas and recommended wilderness areas (table 32). While being classified as not suitable for timber production does not preclude timber harvest, it also does not mandate a regular harvest schedule or artificial restocking where necessary to ensure continued timber production. Therefore, alternative-specific removals of land classified as suitable for timber production may result in a corresponding decrease in timber-industry confidence in a long-term supply of materials bound for the mills and related timber-industry willingness to invest in capital and personnel.

Indicator: Wood Sale Quantity

Although alternatives A and B have equal amounts of proposed mechanical treatment, timber volume sold would decrease by 2.4 percent from current volumes (table 33) because place-based management areas and recommended wilderness areas would be removed from the suitable timber base. Fuelwood volume produced in conjunction with mechanical treatments would be similar to current levels. Ecological benefits from wood sales—reducing tree density in overstocked stands (reduced fire risk, reduced

[34] Where not already excluded because of legal or technical reasons.

vulnerability to climate change) and economic benefits to the timber industry (stability, profits) and its employees (jobs, income)—would decrease slightly from current levels. Any harvest-related short-term negative effects on soil are expected to be outweighed by long-term benefits to soil condition.

Environmental Consequences – Alternative C

Indicator: Fuelwood Availability

The availability of fuelwood would increase an average of 28.6 percent—from a range of 9,000 to 12,000 up to a range of 12,000 to 15,000 cords. This would help meet public demand for higher fuelwood availability; associated social (firewood gathering) and economic (commercial firewood sales, reduced heating costs) benefits would substantially increase as well. Compared to current levels, this alternative would reduce the risk of uncharacteristic wildfire by further reducing accumulations of downed fuel and ladder fuels.

Indicator: Land Classified as Suitable for Timber Production

The amount of land classified as suitable for timber production would decrease slightly (0.8 percent) compared to alternative A, the no-action alternative (table 32). This is mainly because of conservation management areas[35] (unique to alternative C), which are not classified as suitable for timber production; however, this reduction is countered by a 40 percent increase in proposed mechanical treatment (table 31).

While being classified as not suitable for timber production does not preclude timber harvest, it also does not mandate a regular harvest schedule or artificial restocking where necessary to ensure continued timber production. Therefore, where there is a decrease in land classified as suitable for timber production, there may be a corresponding decrease in timber-industry confidence in a long-term supply of materials bound for the mills, which may in turn influence timber-industry willingness to invest in capital and personnel. Compared to the no-action alternative, any such negative effect on the industry would likely be minimal under this alternative.

Indicator: Wood Sale Quantity

The volume of wood products sold is primarily influenced by the amount of mechanical treatment (harvest). Alternative-specific differences in proposed acreages of mechanical treatment (table 31) are reflected in the projected wood sale quantities (row E in table 33), with alternative C proposing a large (30.5 percent) increase in total wood volume sales over the no-action alternative. Timber volume sold would increase by 30.6 percent from current volumes (table 33), and fuelwood volume produced in conjunction with mechanical treatments would rise by about 33 percent.

Increases in wood sale quantity that would be realized under alternative C would have concomitant benefits in the wood products industry (sales, capital investments) and its employees (jobs, income). Proposed increases in the availability of wood products would also have beneficial ecological effects, as proposed mechanical treatment would target overstocked stands in the Ponderosa Pine Forest and Dry Mixed Conifer vegetation types, thereby reducing the risk of uncharacteristic, high-severity fire and vulnerability to climate change (Triepke et al. 2014).

[35] Where not already excluded because of legal or technical reasons.

Environmental Consequences – Alternative D

Indicator: Fuelwood Availability

The availability of fuelwood would remain at 9,000 to 12,000 cords. The public demand for higher fuelwood availability would not be met; associated social (firewood gathering) and economic (commercial firewood sales, reduced heating costs) benefits would remain at current levels. Accumulations of downed fuel and ladder fuels would continue to contribute to risk of uncharacteristic wildfire.

Indicator: Land Classified as Suitable for Timber Production

Land classified as suitable for timber production would decrease by 6.8 percent because of acreage removed for recommended wilderness areas (table 32).[36] While being classified as not suitable for timber production does not preclude timber harvest, it also does not mandate a regular harvest schedule or artificial restocking where necessary to ensure continued timber production. Therefore, alternative-specific removals of land classified as suitable for timber production may result in a corresponding decrease in timber-industry confidence in a long-term supply of materials bound for the mills and related timber-industry willingness to invest in capital and personnel.

Indicator: Wood Sale Quantity

Although alternatives A and D have equal amounts of proposed mechanical treatment, timber volume sold would decrease by 3.3 percent from current volumes (table 33) because recommended wilderness areas would be removed from the suitable timber base. Fuelwood volume produced in conjunction with mechanical treatments would be similar to current levels. Ecological benefits from wood sales—reducing tree density in overstocked stands (reduced fire risk, reduced vulnerability to climate change) and economic benefits to the timber industry (stability, profits) and its employees (jobs, income)—would decrease slightly from current levels.

Cumulative Environmental Consequences

A continuous, sustainable supply of forest products relies on sound vegetation management, both on and off the Cibola. Thinning and prescribed fire treatments may reduce the risk of stand-replacing fire and help ensure a continuous supply of forest products from the Cibola and adjacent lands, providing complementary support to the public and the wood products industry. Also, the benefits of interagency resource sharing have been increasingly realized through an "all-lands approach" to natural resource management. Forest management projects are becoming increasingly cooperative, resulting in cross-jurisdictional collaborations. This increases opportunities for all parties involved.

To illustrate how the all-lands approach is being realized, ongoing and planned projects (within the life of the Cibola plan) adjacent to (within ten miles) the Cibola were identified in the New Mexico vegetation treatment geodatabase, created by the New Mexico Forest and Watershed Restoration Institute (NMFWRI) for the Forest and Watershed Health Coordinating Group (https://nmfwri.org/gis-projects/nm-vegetation-treatment-mapping). This geodatabase allows the user to visually identify specific projects interactively in an online GIS interface and to download text files with detailed information for each project.

[36] Where not already excluded because of legal or technical reasons.

Forty-three cooperating agencies have signed a memorandum of understanding as units of government representing diverse interests and communities such as soil and water conservation districts, city and county governments, tribes, land grants, and State and Federal agencies. Their respective vegetation management plans, as well as community wildfire protection plans, are on file in the Cibola National Forest Supervisor's Office. These plans share a common philosophy with the Cibola of sound multiple-use land management that provides ecosystem services, such as forest products, while promoting ecosystem health and public safety. As such, extra-agency vegetation management projects that occur, or are planned to occur (over the life of the Cibola plan), off the national forest often mimic those of the Cibola in methods and goals (table 18). These projects total over 15,000 acres and largely consist of mechanical thinning or prescribed burning to reduce density and fuel loading in overstocked stands to improve ecosystem function and reduce the risk of uncharacteristic, catastrophic fire while reducing vulnerability to climate change. These projects are key to ensuring a continuous, sustainable supply of forest products to the public and to the wood products industry.

In 2016, the Cibola personnel and cooperating agencies participated in the formation of a collaborative for each of the four mountain districts and a forestwide collaborative—the Cibola Shared Stewardship Collaborative. Cibola personnel joined with partners to kick off these formal collaboration teams consisting of members of the public and nonprofit and government entities. The purpose of the collaborative is to provide input to the Cibola leadership team on the use and management of the Cibola's multiple resources. This ongoing communication among the Cibola and its partners, along with real-time, up-to-the-date project information sharing via the New Mexico Forest and Watershed Restoration Institute, ensures the philosophy of an all lands approach manifests itself in on-the-ground, synergistic benefits among the Cibola, adjacent landowners, and its partners, including the wood products industry. Cibola vegetation management projects are expected to be complemented and enhanced from nearby projects on adjacent lands. In addition to mechanical treatments, prescribed fire treatments also enhance sustainable forestry, production of forest products, ecological health, and economic stability by reducing risk of uncharacteristic wildfire and vulnerability to climate change. Assuming best management practices are followed, cumulative environmental consequences for all indicators of sustainable forestry and forest products are expected to be beneficial for all ongoing and planned projects.

Traditional Communities and Uses

This section provides an overview of the affected environment and an assessment of the potential environmental impacts as a result of each alternative to central New Mexico traditional communities and uses on the Cibola National Forest. A traditional community is a federally recognized tribe or a land-based rural community that has a long-standing history in and around the lands managed by the Cibola. Although all forests have a connection to their local communities, the depth of the relationship of local tribes and traditional communities to the lands and resources of the Cibola began a very long time ago. For many of the small unincorporated and incorporated communities the connection to the land predates the establishment of the National Forest. For the members of land grants-*mercedes* and acequia associations, the origins of their ties to the Cibola lies in Spanish colonial and Mexican times, prior to the region's acquisition by the United States. For federally recognized tribes, the connections to the land date from time immemorial.

There are many traditional communities within the Cibola National Forest plan area, each being geographically and historically rooted to a particular landscape. These traditional communities have strong historic, cultural, and social connections to the land. The communities rely on the Cibola and its natural resources to sustain their traditions and their cultural, spiritual, and economic way of life. The Federal government and federally recognized tribes have a unique government to government relationship of one sovereign nation to another. This relationship is legally distinct from that of other traditional communities, interests and constituencies, and is clarified in treaties, statutes, executive orders, and case law enacted and interpreted for the protection and benefit of federally recognized American Indian Tribes. Due to this distinct relationship, the land management plan distinguishes between federally recognized tribes and other land-based rural communities.

The draft land management plan seeks to build on past initiatives and continues to recognize and support the traditional uses associated with the Cibola. The plan provides a programmatic framework that guides management actions but does not authorize site-specific activities. However, the range of activities proposed in the alternatives for the land management plan may have effects or longer-term environmental consequences to the resources and lands accessed and used by traditional communities. The draft land management plan alternatives considered the laws and authorities that direct Forest Service personnel to administer forest management activities and uses in a manner that is sensitive to and provides access and use for traditional cultural practices; that accounts for the protection of tribal lands and interests; and is integral to our relationship with federally recognized tribes.

Affected Environment

The Cibola manages the natural resources and landscapes that sustain central New Mexico traditional communities, their cultures, and their traditions. Local heritage, culture, traditions, and values have been handed down over generations and for the most part predate acquisition of the area by the United States. Long-standing use of the Cibola and its natural resources are fundamental to the economic, social, and cultural vitality of many central and northern New Mexico inhabitants, including federally recognized Tribes, Spanish and Mexican land grants-*mercedes* and acequia associations, grazing producers, and other rural historic communities. These important uses (traditional uses) include:

- use of common waters (for example, acequias or irrigation ditches) for drinking, irrigating crops, and watering livestock
- use of common pasture for grazing livestock
- wood gathering for fuelwood, building material, and ceremonial uses
- gathering of soil and rocks (for example, sand, minerals for paint, adobe, or clay) for building materials, and other purposes (such as production of crafts and ceremonial uses)
- gathering of plants for various purposes (religious, medicinal, consumption, and other applications)
- hunting and fishing for food and ceremonial purposes
- religious and ceremonial uses (for example, pilgrimages and shrines)

Recognition and preservation of central New Mexico traditional uses have been an integral part of managing the Cibola and is reflected through various documents (for example, the 1972 regional forester policy memo and the 1968 Hassell report).

Federally Recognized Tribes

American Indians (Native Americans) have occupied and used the lands that comprise the Cibola National Forest since time immemorial. Their use of these lands and the surrounding area began with the earliest human occupation of the Western Hemisphere and persists to the present day. The Cibola shares approximately 102 miles of common boundary with the Navajo Nation, the Pueblo of Zuni, the Pueblo of Isleta, the Pueblo of Sandia, the Pueblo of Laguna, and the Pueblo of Acoma, and is in close proximity to numerous other pueblos and tribal communities. The Cibola routinely consults with and maintains a government-to-government relationship with 23 federally recognized Indian tribes. Of these, 17 tribes have identified the lands administered by the four mountain ranger districts as part of their ancestral territory, within their lands of traditional use, or both. These tribes are the Pueblos of Acoma, Cochiti, Isleta, Jemez, Laguna, Sandia, San Felipe, San Ildefonso, Santa Ana, Santo Domingo, Zia, and Zuni; the Hopi Tribe; the Navajo Nation; the Jicarilla Apache Nation; the Mescalero Apache Tribe; and the Fort Sill Apache Tribe. Each has its own history, traditions, and relationship to the land and other groups.

The Federal government has a trust responsibility to federally recognized tribes based on the U.S. Constitution, treaties, and statutes. The trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal treaty rights, lands, assets, and resources, as well as a duty to carry out the mandates of Federal law with respect to all federally recognized tribes. This responsibility requires the Federal government to consider the best interests of the tribes in its dealings with them and when taking actions that may affect them. Trust responsibilities are maintained through consultation and engagement between the tribes and the Cibola. This consultation is critical when proposed activities have a potential to affect tribal interests, including natural or cultural resources of importance. The Cibola employs a variety of avenues to achieve meaningful consultation, with the preferred method being real-time, in-person dialogue between tribal leaders and Forest Service line officers.

Native Americans who have occupied and used the Cibola understand their own history that is distinct and sometimes different from that derived from western scholarly traditions. Geographical features on the landscape are integral to their understanding of history and cultural identity. The cultural history, beliefs, traditions, and practices of federally recognized tribes that are associated with the Cibola are linked to numerous places within the plan area. Traditional knowledge and practices are maintained by passing it from one generation to the next verbally rather than through written texts. The land is the foundation of religious belief and historical context through which these belief systems and cultural traditions are transferred across generations. Native history is described through geographic connections rather than as sequential and temporal events (Deloria 1994). Places, properties, and resources valued and used by the tribes to maintain their cultural identity and cultural traditions have been identified on every unit of the Cibola.

The Cibola manages a great diversity of landscapes and sites that are culturally important and held sacred by the tribes. Some of these places include locations with long-standing cultural use where tribes perform ceremonial activities and gather site specific forest resources (for example, plant, animal, and mineral) in accordance with traditional cultural practices deeply rooted in their belief system and important in maintaining their identity, cultural continuity, and subsistence. These places figure prominently in oral traditions regarding origin, place of emergence and migration. They strengthen ancestral connections and play a vital role in cosmology and contemporary ceremonies, and they form and sustain individual and community relationships. They range from specific localities to broader cultural landscapes (for example, Sandia Cave, Gallinas-Springs Pueblo, Tijeras Pueblo, Las Huertas Canyon and Creek, Mount Taylor, and the Sandia Mountains). A few of these places are formally identified and documented as traditional cultural properties, sacred sites, or as another type of cultural resource, while other places used by tribes are held in confidence to protect their important values.

A traditional cultural property and a sacred site are not necessarily mutually exclusive of each other. A traditional cultural property must meet the definition and criteria for a historic property eligible to or listed on the National Register of Historic Places, whereas a sacred site is identified by the tribe as defined in Executive Order 13007 and does not need to meet the historic property definition and eligibility criteria required for the National Register of Historic Places. Laws and executive orders define the two separately, resulting in differences as to how land management agencies are required to consider and resolve effects from management actions to these two types of places.

The Cibola recognizes the importance of these places and traditions and continues to consult and work with Tribes regarding the access and traditional use of lands and resources managed by the Cibola. Efforts to protect, maintain, and restore places and resources of importance to the tribes and National Forest System lands adjacent to tribal lands include large landscape-scale vegetation and watershed restoration projects, the reduction of hazardous fuels, and the restoration and protection of cultural resource sites or places. Past and current projects include (but are not limited to) the Cedro Landscape Restoration Project, the Zuni Collaborative Landscape Restoration Program Project, and the Isleta Restoration Project. Across the national forest, tribes are collaborating with the Cibola to improve and restore watersheds, springs, wildlife, and forest conditions; control invasive plants; create resilience to wildfires, insects, and diseases; and manage for sustainable recreation. As part of these projects mechanized treatments (thinning) and fire are being used to restore historic vegetative conditions. Benefits from these projects include sustaining and improving habitat and resources that are traditionally used for cultural and religious purposes, and improving conditions and restoring watersheds that are the main water source for some tribal municipalities.

Rural Historic Communities

A rural historic community refers to the nontribal traditional communities of central New Mexico whose families have strong historical ties to the land. The Cibola and use of its resources are integral to the subsistence, cultural, and social values that help define the people and communities. The founding of the community predates the establishment of the Forest Service. The community has a significant concentration of human activity, linkage, and continuity of land use on the national forest, immediately adjacent to the national forest, or both. The day-to-day occupational activities of rural historic communities are rooted in the pragmatic need to make a living, and they evolved on a specific landscape within or adjacent to lands now managed as the Cibola National Forest.

Occupational, subsistence, and cultural-based activities associated with rural historic communities may include livestock grazing, fuelwood gathering, logging, Christmas tree harvesting, pinyon picking, medicinal plant collection, hunting, agriculture, and mining. Many of the communities within and adjacent to National Forest System lands occupy a small land base and have limited opportunities for community development and uses. The Cibola provides opportunities for community interaction and maintenance of traditional culture. Some rural historic communities have evolved to accommodate tourism and the increasing demand for outdoor recreation as an element of their identity, but most rural historic communities and families continue to look to the national forest for economic opportunity and vitality through traditional uses. Due to the geographic extent and disconnected sky islands and landscapes that represent the ranger districts on the Cibola, many people may call one place home and yet rely upon or enjoy a number of resources and uses across the Cibola National Forest. Some people may identify with several rural historic communities. Regardless of their relationships, what these community members have in common is a strong cultural and social tie to the lands in and surrounding the Cibola.

Rural historic communities are divided into two categories: land grants-*mercedes* and acequia (community ditch) associations. These communities are associated with corporate entities that predate the establishment of the national forests and are subdivisions of New Mexico State government, or are recognized by the State of New Mexico. These entities for the most part were established prior to the acquisition of New Mexico by the United States.

The second category are central New Mexico historic communities. These rural communities were founded after the transfer of New Mexico to the United States but before the establishment of National Forest System lands. Central New Mexico historic communities are distinguished by a cultural diversity which mirrors that of New Mexico as a whole. While central New Mexico historic communities are not corporate entities, their residents are represented by county and in some cases village, town, and city governments.

Land Grants-Mercedes Communities and Acequias

Between 1689 and 1846, Spain and later Mexico issued grants of land to individuals, groups, and towns to establish the ownership rights of existing settlers and to promote development on the frontiers of the Spanish Empire and Mexican state that are today part of the American Southwest. The two most common types of Spanish and Mexican land grants-*mercedes* made in New Mexico were community land grants and individual land grants. Community land grants were typically organized around a central plaza and a tract of land to farm, and "common land" was set aside as part of the grant for use by the entire community. Individual land grants, as their name suggest, were issued to specific individuals.

Many traditional Hispanic communities have ties to lands on the Cibola that were once common lands of community land grants-*mercedes*. Land grants utilized the forests as public domain prior to the establishment of the national forest. Common lands provided land grants-*mercedes* communities access to grazing land, stone and clay, wood, game, fish, medicinal plants, water for agriculture and consumption, and other forest products—uses that continue today. Many land grants-*mercedes* are actively involved in the management and preservation of adjacent National Forest System lands for traditional and cultural use. Land grants-*mercedes* are governed by boards of trustees to fulfill this mission through a variety of activities, including managing, protecting, and regulating uses of common lands; preserving cultural and historic resources; and partnering with the Cibola to plan and propose forest restoration projects on National Forest System lands.

Most land grants-*mercedes* are organized as political subdivisions of the State of New Mexico[37]. Those that are not political subdivisions participate through the New Mexico Land Grant Council, which is a State agency that represents the interest of all New Mexican land grants-*mercedes*. The following is a list of all land grants-*mercedes* throughout Cibola:

- Mount Taylor Ranger District – the Cubero and Cebolleta land grants-*mercedes*
- Mountainair Ranger District – the Chililí, Tajique, Torreón, Manzano and Tomé land grants-*mercedes*
- Sandia Ranger District – the San Antonio de Las Huertas, Cañón de Carnué, and San Pedro land grants-*mercedes*.

[37] New Mexico Statutes Annotated 1978 sections 49-1-1 to 49-1-23.

These land grants share approximately 72 miles of common boundary with the national forest. Additional community land grants-*mercedes* in the Cibola's area of influence include Sevilleta de la Joya and Atrisco. A few have former common lands now managed by the Forest Service. All land grants-*mercedes* have expressed an interest in adjacent National Forest System lands.

Acequias are community operated and organized water irrigation systems. Many of the state's acequia associations have been in existence since the Spanish Colonial period in the 17th and 18th centuries and were historically associated with land grants-*mercedes*. Acequia and community ditch associations are political subdivisions of the State of New Mexico and occupy a unique place in forest management. Acequias that existed on unreserved public lands for use in connection with a valid water right, prior to the withdrawal of public lands to create the national forests, are afforded valid rights and status under National Forest System management. Much of the water diverted by acequias comes from National Forest System lands and can be affected by forest management activities upstream. Acequias are still relevant and vital water delivery and community organizing systems today. They serve as important water infrastructure for communities, and their associations are important community organizations throughout New Mexico.

There are many areas of importance to land grants-*mercedes* communities and acequia associations on the Cibola National Forest. One documented area of importance is the Las Huertas Canyon Historic District, a traditional cultural property.

Central New Mexico Historic Communities

Central New Mexico historic communities are those that arose during the Territorial era (A.D. 1848 to 1912), after the acquisition of New Mexico by the United States. These communities were founded prior to the establishment of the forest reserves that would later be consolidated into the Cibola National Forest. The founding of these was based in part on the U.S. government's policies to encourage homesteading and ranching, and the drive for resources to meet the demands of the economy of a growing nation. Each community has a significant concentration of human activity, linkage, and continuity of land use on the national forest, immediately adjacent to the national forest, or both. These forces led to communities that were diverse in their composition, having been founded by people from both existing New Mexico communities and from other parts of the United States and the world. This diversity persists to this day, and is a hallmark of central New Mexico rural historic communities.

Central New Mexico historic communities are those whose day-to-day occupational activities are rooted in the pragmatic need to make a living and that evolved in place on a specific landscape on or adjacent to the lands now managed as the Cibola. Corporations and special interest groups are not included in this category. Examples of central New Mexico historic communities include the Village of Magdalena, founded as a center for mining and ranching in 1884 and located in the area of influence for the Magdalena Ranger District; and the community of Ramah, founded as a farming settlement in 1882, and located in the area of influence for the Mount Taylor Ranger District. Examples of other central New Mexico historic communities include Corona (1899), Datil (1884), Grants (1882), Monticello (1881), Mountainair (1901), and Tijeras (1888). There are over two dozen of these communities in addition to the examples listed here. Communities such as these are located throughout the area of influence for the Cibola. Occupational and subsistence-based activities associated with rural historic communities have included agriculture, grazing, mining, logging, and transportation (railroads, stage lines, and U.S. highway networks). Over time, some of these communities have evolved to accommodate tourism and the increasing demand for outdoor recreation as an element of their identity and their economy.

Cibola personnel are collaborating with rural historic communities on large landscape-scale vegetation and watershed projects, hazard fuels reduction treatments, and other types of partnerships to sustain the availability of traditional used resources and activities. These projects include treatments and activities that improve and restore: watersheds, springs, wildlife habitat, and forest conditions; control invasive plants; create resilience to wildfires, insects and diseases; and manage for sustainable recreation. As part of these projects mechanized treatments (thinning) and fire are being used to restore historic vegetative conditions. Benefits from these projects include sustaining and improving riparian habitat, grassland, and timber resources that are traditionally used for subsistence, that contribute to the traditional livelihood of the community, or both and improving conditions and restoring watersheds that contribute to surface waters that are used for domestic and agricultural use.

Methodology and Analysis

The range of management activities proposed in the alternatives for the draft land management plan are used to evaluate the potential effects to federally recognized tribes and rural historic communities. The kinds of resource management activities allowed under the prescriptions are reasonably foreseeable future actions to achieve the goals and objectives of the land management plan. The effects analysis is intended to be useful for comparing and evaluating alternatives on a plan-area basis.

Assumptions for Analysis

- The land management plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carry out any project or activity. Because the land management plan does not authorize or mandate any site-specific projects or activities (including ground-disturbing actions) there can be no direct effects. However, there may be implications or longer-term environmental consequences of managing the forests under this programmatic framework.
- The plan decisions (desired conditions, objectives, standards, guidelines, special areas, suitability, monitoring) will be followed when planning or implementing site-specific projects and activities.
- Analysis and impacts to places of importance to American Indians from site-specific actions will be addressed at the time site-specific decisions are made.
- Members of federally recognized American Indian tribes would continue to access, use, and conduct religious pilgrimages and ceremonies at known traditional cultural properties and sacred sites; and collect and use Cibola resources for traditional cultural purposes.
- Members of traditional rural communities would continue to access, use, and collect Cibola resources for traditional uses.
- Law, policy, and regulations will be followed when planning or implementing site-specific projects and activities.
- Acres treated by fire and mechanical methods are cumulative over the life of the plan.
- Changes to the transportation system that have the potential to effect the access and use of Cibola resources for traditional purposes would be analyzed at the project level planning.

- None of the alternatives prohibit future site-specific project planning that contributes to the development of social, cultural, and economic opportunities.
- Fire could occur across all National Forest System lands.
- Unplanned ignitions are analyzed at the time of the start and documented in the Wildland Fire Decision Support System (WFDSS). Management response to a wildfire is based on objectives appropriate to conditions of the fire, fuels, weather, and topography to accomplish specific objectives for the area where the fire is burning. Affects to cultural resources are considered when determining the objectives and management response to a wildfire.

Indicators and Measures

This analysis is based upon the following indicators:

- Access to traditional cultural places and gathering traditional resources.

  Measure: Changes to the transportation system, actions that may affect access to traditionally used resources and locations, or both.

- Availability, abundance, and sustainability of traditionally used locations and resources.

  Measure: Qualitative analysis of the number of acres and areas restored and treated by mechanical and non-mechanical methods (fire) that may benefit traditionally used resources and areas identified by tribes and rural historic communities. The number of acres, areas, or both that are designated or proposed as management areas that enhance, maintain, or protect the availability, abundance, and sustainability of lands and resources traditionally important to tribes and rural historic communities.

- Opportunities for solitude and privacy for tribal traditional and cultural activities.

  Measure: The number of acres identified in the recreation opportunity spectrum as primitive, semi-primitive nonmotorized, or semi-primitive motorized and the number of acres designated or proposed as wilderness.

Access for Gathering Traditional Resources and Availability, Abundance and Sustainability of Traditional Resources

Access to and the availability, abundance, and sustainability of traditional places and resources has been identified as important by federally recognized tribes. This analysis primarily considers changes to the access, availability, abundance, and sustainability of resources and places that are traditionally used for subsistence, religious, medicinal, and other cultural purposes. Analysis and potential effects to the access and the availability of water for domestic and agricultural use, salable mineral resources, (such as flagstone, moss rock, and other building material), commercial use of special forest products (primarily pinyon nuts), are discussed in the "Socioeconomic Resources" or "Sustainable Forestry and Forest Products" sections of this chapter. Access to and the availability of fuelwood and timber (for construction) by rural historic communities is found in the "Sustainable Forestry and Forest Products" section of this chapter but are also considered in this analysis in terms of available fuelwood permits.

All of the plan area can be accessed by federally recognized tribes and rural historic communities, with the exception of areas under current closure orders. Management activities and actions may effect access to federal lands and resources on a temporary or permanent basis (closure orders, land exchanges, special use permits) and how these areas and resources may be accessed (nonmechanized, mechanized, motorized uses). Access to areas and resources located within designated wilderness is limited to nonmotorized, nonmechanized travel methods. The action alternatives vary in the amount of acres proposed as management areas and designated areas (such as wilderness), and in the amount of acres proposed for restoration using prescribed fire and mechanical treatments. During implementation of restoration projects and other activities (including timber sales, road maintenance, and permitted uses) roads and areas may temporarily be closed to nonproject personnel, which could temporarily prevent access to traditionally used areas and resources. Exchanges of Federal lands may affect, prevent, or both the access to lands and resources used by tribes and rural historic communities. Once the lands are transferred out of federal ownership, the tribes would not be guaranteed the same rights of access to the area for traditional proposes. Federal laws, executive orders, regulations, and Forest Service policy regarding American Indian rights and interests would no longer apply. Land adjustments may also potentially have a positive effect on access to areas and resources used for traditional purposes. Resources and areas located on acquired private lands that were previously inaccessible could become accessible for traditional proposes.

Changes in the transportation system may effect access to areas and resources used for traditional cultural purposes. Federally recognized tribes have stated motorized access is important to be able to utilize traditionally used plants and mineral resources found within the plan area. All national forest system roads that are open to the public (maintenance levels 2 through 4) are available to federally recognized tribes and rural historic communities for motorized access to areas and resources. In addition to having access using open system roads, Cibola personnel upon request provide members of federally recognized tribes permission to use system roads that are closed to the general public (level 1 roads) to access to areas and resources used for traditional cultural practices. Members of rural historic communities may also access forest products and areas through motorized methods but are limited to the system roads open to the public. None of the action alternatives propose changes to the miles of open system roads. Differences are found between the alternatives in the miles of level 1 system roads that are proposed to be decommissioned. Decommissioning a closed road permanently removes the road from the national forest transportation system, and it is no longer available for motorized use by federally recognized tribes or for future administrative use.

The availability, abundance, and sustainability of Federal land and natural resources is important to federally recognized tribes and rural historic communities. Areas and resources that are used for subsistence, religious, medicinal, and other cultural purposes may be affected by the action alternatives. Action alternatives propose management and designated areas and restoration activities that are intended to restore and manage for the sustainability and resiliency of forest resources and wildlife habitat. Restoration efforts and the standards, guidelines, and objectives for management and designated areas that maintain, restore, protect, increase, or some combination of these things the availability and the amount the resource (water, vegetation, and habitat) will have a beneficial effect on the abundance and availability of traditional resources to Tribes and rural historic communities. While important resources vary between communities, important plants are grasses, herbs, forbs, succulents, shrubs, and trees. Many of these important species fall in two categories: species that respond and favor areas disturbed by fire and other activities, and species that favor riparian areas.

Changes in the availability, abundance, and sustainability of species that favor disturbed areas by fire are measured by examining changes in disturbance forces between alternatives: acres burned by wildfire managed for resource benefit, acres burned by prescribed fire, and acres mechanically treated and then burned by prescribed fire. Acres treated by broadcast burning only are derived by subtracting the mechanically treated acres from the prescribed burning acres for each alternative. During consultation, tribes expressed support for the use of fire as a treatment to encourage the availability, abundance, and sustainability of traditionally used species. Therefore, this analysis considers acres of wildfire managed for resource benefit and prescribed fire the most immediately productive for restoring and improving availability of species. In areas subject to mechanical treatment, the availability of species would be anticipated to decline during, and immediately following, treatment, depending upon the volume of woody debris left on the landscape. However, the availability and abundance of fire-adapted species in mechanical treatment areas that are followed by prescribed burning would increase after implementation was completed.

Opportunities for Solitude and Privacy for Tribal Traditional and Cultural Activities

The opportunity for tribal members to conduct traditional and cultural activities in an atmosphere of solitude and privacy can be measured by the likelihood they will encounter other parties while such practices are underway. The recreation opportunity spectrum divides the plan area into categories according to qualities of value to forest visitors which includes solitude. The action alternatives propose and identify differences between recreational opportunities by the amount of acres found within each category of the recreation opportunity spectrum. Primitive, semi-primitive nonmotorized, and semi-primitive motorized categories are associated with very high, high, and moderate levels of solitude, respectively (USDA Forest Service 1994b). However, when the specific factor of social encounters is considered, the primitive category provides a greater likelihood of not encountering others. The likelihood of encountering others is approximately the same for the semi-primitive nonmotorized and semi-primitive motorized categories (USDA Forest Service 1990). Changes in the ratio between these three categories, and the categories not associated with solitude (rural and roaded natural), measure the overall solitude available for the practice of traditional and cultural activities. Changes in the ratio between the primitive category and the semi-primitive nonmotorized and semi-primitive motorized categories measures changes in the quality of that solitude, insofar as the solitude enjoyed also affords privacy.

Environmental Consequences

Environmental Consequences Common to All Alternatives

Access for Gathering Traditional Resources

All alternatives provide for nonmotorized and motorized access to resources and areas used for traditional purposes. The miles of system roads (levels 2, 3, and 4) open to the public is the same for all alternatives. The miles of roads available for members of land grants, acequia associations, and central New Mexico historic communities to access traditionally used resources remains the same across all alternatives. The miles of roads available to the members of federally recognized tribes to access traditionally used resources without a permit remains the same across all alternatives.

Availability, Abundance, and Sustainability of Traditional Resources

Management practices that promote the availability, abundance, and sustainability of plant species that rely on disturbance are found in all of the alternatives. The three management practices associated with favorable disturbance—wildfire managed for resource benefit, prescribed fire, and mechanical treatment followed by prescribed fire—are included in all alternatives. The lands of the Cibola are located in a fire-adapted ecosystem. Many of the traditionally used plants increase productivity in response to fire. Increasing the acres where fire may be used would potentially increase the productivity of traditionally used forest resources and availability of those resources across the landscape.

Management practices that affect the availability, abundance, and sustainability of plant species that occur in riparian environments and environments associated with springs are found in all alternatives. All the alternatives would potentially result in virtually no change in the numbers of springs that are at low risk (71 springs for the no-action alternative versus 72 springs for alternatives B, C, and D). There is also little change in the number of riparian area acres at low risk between all alternatives (844 acres for the no-action alternative versus 829 acres for alternatives B, C, and D). All alternatives would reduce the number of springs and riparian areas that remain at high risk. Conditions found at high-risk springs and riparian areas have the potential to reduce the presence and number of plants used for traditional purposes and increase the potential that water and resources collected from these places are not available or are less abundant, potentially affecting the sustainability of traditional practices. Reducing the conditions found at high-risk springs would result in improving the potential to maintain or increase the availability, abundance, and sustainably of traditionally used plant species found at springs and riparian areas and promote a greater likelihood of sustaining the traditional practices that occur at these locations.

The availability, abundance, and sustainability of nonsalable mineral resources used in fine arts production and in religious and other cultural practices will not vary between alternatives. There are no proposed changes in the management of these resources forestwide or in specific management areas for any of the alternatives.

Opportunities for Solitude and Privacy for Tribal Traditional and Cultural Activities

All alternatives afford broad opportunities for Tribal members to experience solitude and privacy for traditional and cultural activities. Between 78.1 and 86.6 percent of the plan area is located within the primitive, semi-primitive nonmotorized, and semi-primitive motorized categories. Differences are found within the alternatives in the amount of acres available to experience solitude and privacy without audible intrusions from motorized use or other disruptions by motorized or mechanized vehicles.

Environmental Consequences – Alternative A

Access for Gathering Traditional Resources

Under the no-action alternative, motorized access under permit by members of federally recognized Tribes could be reduced by up to one mile annually, or up to 10 miles over a 10-year period. Over 10 years, this would reduce the total miles of system roads available for access from 3,129 miles to 3,119, a reduction of 0.6 percent. Decommissioning and obliterating a system road has the potential to reduce or eliminate types of motorized access to traditionally used resources and areas. Some individuals within traditional historic communities that have limited physical mobility or do not have access to all-terrain vehicles or other modes of cross country travel (such as pack stock) would not be able to access areas and resources that were previously accessible using passenger vehicles.

While the location of any particular road decommissioned and obliterated could be significant for access to a particular resource, this potential impact would be considered during the project level analysis. Given the size of the reduction, there is virtually no change in motorized access to resources and areas traditionally used by federally recognized tribes and rural historic communities.

Management and guidelines for Cibola resources within the no action alternative were developed prior to the passage or issuance of specific statutes and executive orders that provide traditional communities the access to and use of forest lands, resources, and sacred sites. Management emphasis is on providing commodities and multiple use activities that may not be compatible with access to traditional resources and areas. This has a higher potential to adversely affect access to forest lands and resources for traditional practices.

Availability, Abundance, and Sustainability of Traditional Resources

The no-action alternative allows disturbance activities favorable to plants on a maximum of 26,000 acres. Over 10 years, this would result in favorable conditions occurring across 260,000 acres, or approximately 16 percent of the total plan area. Most of the acres of disturbance favorable to plants, a maximum of 20,000 acres or 77 percent, comes from the management of fire for resource benefit. A maximum of 5,000 acres, or 19 percent would come from acres mechanically treated and then prescribed burned. This would result in a short-term decrease in the availability of traditionally used plant species within the acres treated until implementation is complete. The availability of plant species that favor disturbance would increase in these areas once treatment activities have been completed. The increase in productivity would provide more plant availability and greater numbers of plants for potential traditional use.

Under the no-action alternative, over 70 percent of mapped springs and greater than 85 percent of riparian areas are located in management areas that allow for higher levels of activities (for example, livestock use, vegetation treatments, roads, new roads and motorized trails, mining, lack of prescribed fire) that have the potential to affect water resources (see the "Water Resources" section). Impacts that may result from these activities include loss of vegetation, compaction, erosion, increased runoff, changes in water quality, and changes to the condition of riparian areas. These types of impacts have the potential to directly and indirectly effect the availability, abundance, and sustainability of water, vegetation, and wildlife found in these environments that are used for traditional cultural practices, ceremonial practices, or both. In the no-action alternative, management activities that could potentially impact the springs and riparian areas (such as compaction, soil erosion, and sedimentation that lowers water quality) where traditionally used plants that favor these environments may occur will continue to leave most of these environments at high risk.

Within the no-action alternative, none of the 18 geographic management areas in the 1985 plan emphasize promoting the availability, abundance, or sustainability of Cibola resources of importance to traditional communities. However, some of these management areas emphasize activities that utilize fire treatments or emphasize the management of riparian areas in ways that are favorable to traditionally used plants. Management activities that maintain and restore riparian areas and springs provide conditions for increasing the presence and abundance of traditionally used plant species and water resources. Treatments using fire increases the productivity of traditionally used plant species which maintains or increases the availability of those species. As a result of these management actions, there is a greater potential of traditionally used plants, forest products, and water sources that are available to federally recognized tribes and rural historic communities to continue and sustain their traditional cultural practices.

The no-action alternative would provide access and availability of fuelwood for traditional subsistence, and ceremonial practices. Between 9,000 and 12,000 cords of fuelwood would be provided annually through the issuance of fuelwood permits. This would be the same amount available under alternatives B and D but lower than the annual amount available under alternative C at 12,000 to 15,000 cords. The no-action alternative would provide less fuelwood annually available than the proposed action (alternative C). The lowered level of fuelwood would have potential effects on the economics of subsistence-based traditional communities, such as not having as much fuel to heat their homes or lessened supplemental income from selling collected fuelwood.

Under the no-action alternative, one project design or protection measure would be integrated into projects or management activities annually to benefit locations of traditional and cultural importance to rural historic communities and tribes. This would result in a very small difference in comparison to the action alternatives. Project or management benefits may include treatments specifically designed to restore or protect a traditionally used spring from current or potential impacts from grazing or incompatible development, prescribed burning to increase plant species used for traditional practices, and burning or mechanical treatments to protect traditionally used areas or tribal resources.

Opportunities for Solitude and Privacy for Tribal Traditional and Cultural Activities

The no-action alternative affords broad opportunities for tribal members to experience solitude and privacy for traditional and cultural activities, as 86.2 percent of the acres of the plan area fall within the primitive, semi-primitive nonmotorized, and semi-primitive motorized categories. Under the no-action alternative, 6.2 percent of all acres fall within the primitive category that provides the highest quality solitude and privacy. This is slightly less than the proposed action (alternative C) at 6.5 percent, somewhat less than alternative B at 9.6 percent, and substantially less than alternative D at 18.8 percent. The effect of less acres available for quality solitude is the potential increase in disturbance to tribal users from non-participants (visitors) during traditional cultural activities or ceremonies.

Environmental Consequences Common to Alternatives, B, C, and D

Access for Gathering Traditional Resources

Alternatives B, C, and D reduce the system road miles available for members of federally recognized tribes to access traditionally used resources relative to the no-action alternative. Alternatives B, C, and D could result in the decommissioning of up to between 30 to 50 miles greater than the no-action alternative over 10 years. While this is a 200 to 400 percent increase in miles obliterated relative to the no-action alternative, the overall change is small relative to the total remaining road miles available for motorized access. Relative to the total miles available, the action alternatives represent a change of only 1.0 to 1.6 percent difference in road miles available for motorized access to areas and resources. While the location of any particular road obliterated could be significant for motorized access to a particular resource, this potential impact would be considered at the project level.

Availability, Abundance, and Sustainability of Traditional Resources

Alternatives B, C, and D substantially increase the potential for availability, abundance, and sustainability of plants and forest products that positively respond to disturbance and are used for traditional purposes. The number of acres that would potentially be affected by the three sources of disturbance would increase between 50 and 85 percent relative to the no-action alternative, or an increase from a maximum of 26,000 acres to between a maximum of 39,000 acres to 48,000 acres. Most of this increase is in the number of estimated acres where wildfire will be managed for resource benefit. Many of the traditionally used plants respond to fire by increasing productivity.

This would potentially increase the long-term productivity of traditionally used forest resources and availability of those resources across the landscape. Conducting prescribed burns has the potential to restore the natural and cultural landscape, and the natural fire regime, reducing the potential for permanent adverse effects from high-intensity, high-severity fires. This would potentially increase the abundance, availability, and sustainability of Cibola resources by improving forest and watershed conditions that provide water, plants, and forest products that are traditionally used.

Alternative C is the only action alternative where there is an increase in disturbance due to mechanical treatment followed by prescribed burning relative to the no-action alternative. These acres increase from a maximum of 5,000 acres to a maximum of 7,000 acres per year. This would result in a short-term decrease in the availability of plant species in the acres treated until implementation is complete. The availability of plant species that favor disturbance will increase in these areas once treatment activities have been completed.

Alternative C would provide 12,000 to 15,000 cords of fuelwood annually through the issuance of fuelwood permits. This would be the highest amount of cords available through fuelwood permits in comparison to the no-action alternative and alternatives B and D at 9,000 to 12,000 cords annually, resulting in an increase of 3,000 cords available annually. Alternative C would provide the greatest availability of fuelwood to federally recognized tribes, land grants and acequia associations, and central New Mexico historic communities. These communities have identified fuelwood as an important traditional resource. Beneficial impacts from increased amounts of fuelwood on the economics of subsistence based traditional communities would include more fuel to heat homes and more supplemental income from selling fuelwood collected.

Each of the action alternatives substantially decreases high risk activities that would occur near springs and acres of riparian areas where potentially traditionally used plants may occur relative to the no-action alternative. The percentage of springs at high risk due to management activities declines from over 74 percent under the no-action alternative to between approximately 49 and 69 percent for the action alternatives. The decline in the percentage of riparian acres at high risk is less, from greater than 85 percent under the no-action alternative to between approximately 64 and 82 percent under the action alternatives. Decreasing high-risk activities would result in a greater potential for increasing the availability and productivity of traditionally used resources collected from spring and riparian areas. Of the action alternatives, alternative B offers the least reduction in high risk to the riparian areas and springs. Alternative C offers a substantially greater reduction in high risk than alternative B. Alternative D exhibits a slightly greater decrease in high risk to riparian and spring environments than alternative C.

Within the action alternatives, there would be a slight increase over the no-action alternative in the annual amount of protection measures or management activities that would be specifically proposed and integrated into projects to benefit forest resources and traditional use areas identified as important to rural historic communities and federally recognized tribes. Examples of management activities that would benefit traditionally used resources and areas are treatments to protect, maintain, or restore traditionally used springs and riparian areas to assure the availability of water and viability of plant species; fuels treatments that maintain or enhance the productivity of species used for traditional practices; rehabilitation of damaged or disturbed traditional use areas using methods guided by traditional ecological knowledge; and watershed treatments that reduce hazardous fuels to protect water quality and availability of water sources used by tribes, acequia associations, and historic communities.

Alternative B contains two management areas, Mount Taylor and Las Huertas Canyon, which emphasize the availability, abundance, and sustainability of forest products for tribes, land grants and acequia associations, and central New Mexico historic communities. These two management areas total 29,098 acres. Restoration activities in these management areas include the management of wildfire for resource benefit, prescribed burning, mechanical treatment for prescribed burning, and the restoration of riparian areas and springs, will be designed to promote the availability, abundance, and sustainability of traditionally important resources.

Alternative D proposes the most acres for wilderness, which both directly and indirectly provides the most protection of long-term access and availability to traditional cultural properties and sacred sites by eliminating certain management activities that have the potential to adversely affect traditional cultural properties and sacred sites (for example, mechanized treatments and uses, construction of roads and facilities). Alternatives B and C would have the next highest potential to benefit traditional cultural properties and sacred sites. Managing areas for wilderness values would have the highest potential to protect traditional resources and keep them generally free from physical adverse effects. Alternative A does not recommend additional wilderness areas.

Opportunities for Solitude and Privacy for Tribal Traditional and Cultural Activities

There are differences in the quality of solitude and privacy between the no-action alternative and the action alternatives. For the three action alternatives, the percentage of recreation opportunity spectrum acres within the combined semi-primitive motorized, semi-primitive nonmotorized, and primitive categories remains consistent, between 86.2 and 86.6 percent of total acres. This is essentially the same as the no-action alternative at 86.2 percent. The action alternatives have greater quantities of primitive acres that offer the greatest amount of privacy ranging between 6.5 and 18.8 percent of total acres compared to the no-action. The effect of more acres available for quality solitude is the reduction of potential intrusions to tribal users by nonparticipants (visitors) during traditional practices and ceremonies.

Alternative D provides the most acres available for solitude and privacy for the practice of traditional and cultural activities when compared to both the no-action alternative and alternatives B and C. Alternative D recommends the most acres for designated wilderness. This would have the highest potential to benefit and provide solitude and privacy for practicing traditional cultural activities by reducing the potential for audible mechanized and motorized intrusions and the number of nonpractitioners, the potential interactions with nonpractitioners, or both while traditional practices or ceremonies are being conducted. Alternative D includes the most acres available for the highest quality solitude. The percentage of acres in the primitive category is 18.8 percent, three times greater than the no-action alternative at 6.2 percent, and almost three times as great as alternative C at 6.5 percent. The percentage of total acres in the primitive category for alternative D is also almost twice as great as those for alternative B at 9.6 percent.

Cumulative Environmental Consequences

The use of resources and places important to traditional communities began decades, centuries, or millennia prior to the establishment of the Cibola National Forest. As such the distribution of resources and places important to traditional communities in many cases crosses current jurisdictional boundaries, and occur on Federal, State, tribal, land grant common, and private lands. In addition, activities conducted on lands adjacent to the Cibola can also affect access to resources; the availability, abundance, and sustainability of resources; and the opportunities for solitude and privacy on the Cibola National Forest.

Current and previous Forest Service management activities, public resource procurement and recreational use and natural processes have impacted the access and use of traditional cultural areas and resources. Tribes view sacred sites and traditional cultural properties that are part of their traditions as interconnected places and features of the religious and traditional landscape. Effects to these places and features may directly or indirectly affect the access and use by the tribes to conduct ceremonial practices, traditional practices, or both of other sacred sites or traditional cultural properties that are part of their traditions. Some of the past impacts to access and the availability of traditional cultural properties, sacred sites and traditionally used resources on lands within New Mexico include (but are not limited to) past mineral exploration and uranium mining on Mount Taylor, development of ski areas and communication sites on sacred mountains, recreational uses such as camping and sport climbing and other activities within or on traditional cultural property caves and buttes; land exchanges; oil and gas developments in the San Juan Basin, and intentional vandalism and looting that damage or destroyed cultural sites.

Cumulative effects for the three indicators are assessed by examining existing programmatic land management plans for adjacent jurisdictions, both in relation to resources and areas directly of concern for traditional communities, and for the measures (transportation network, vegetation treatment, prescribed fire, wildland fire managed for resource benefit, spring and riparian area condition, and recreation opportunity) used to evaluate changes in the indicators. Draft or completed management plans are available for Bureau of Land Management resource areas, tribes, and counties. Plans that address some of the same indicators examined in this effects analysis are resource management plans for the Bureau of Land Management Rio Puerco and Socorro Field Offices, and forestry management plans for the Pueblos of Acoma and Isleta. These plans, as well as other jurisdiction plans provide information used in the cumulative effects analysis. Information from other management plans regarding current and reasonably foreseeable conditions is not precise enough to distinguish between cumulative effects for each alternative. As such, cumulative effects are discussed for all alternatives relative to each of the three indicators.

Access for Gathering Traditional Resources

The no-action and action alternatives do not proposed direct and indirect effects that would result in cumulative adverse effects on access to traditional cultural areas and resources. The alternatives do not propose disposing federal lands out of federal ownership, but they do not prevent this action. Federal lands in the vicinity and adjacent to the Cibola may transfer out of federal ownership, which may result in the importance of access to Cibola lands for traditional cultural purposes. The 2012 Bureau of Land Management Rio Puerco draft resource management plan indicates this resource area intends to dispose of between approximately 55,000 and 62,000 acres of Bureau of Land Management land by sale or transfer. This will likely result in a loss of access by traditional community members to resource gathering areas that occur in those areas (USDI Bureau of Land Management 2012). This is particularly true if these lands pass into private ownership. In contrast, the 2010 Bureau of Land Management Socorro resource management plan authorizes field office personnel to acquire land in support of cultural resource management goals, dependent upon site significance, management feasibility, partnership potential, and community support for acquisition (USDI Bureau of Land Management 2010). If lands acquired contained sites or areas used for gathering traditional resources, this could increase access opportunities for traditional community members.

Availability, Abundance, and Sustainability of Traditional Resources

The no action and action alternatives are not proposing changes in the management of minerals and lands. Alternatives B and D have the greatest potential for indirect cumulative beneficial effects by proposing the most acres for wilderness or management areas that benefit traditional cultural areas and resources. This would result in less potential for those proposed lands and resources to become unavailable for traditional use through transfer of federal ownership or damaged or destroyed by actions that may include recreational developments, mining, oil, gas, and geothermal development. Proposed action alternatives are expected to increase the availability, abundance and sustainability of traditional resources by implementation of proposed objectives that lead to the restoration and sustainability of forest resources. Adjacent Bureau of Land Management units are not proposing changes to current fire management practices that would lead to cumulative adverse effect on the access and use of resources for traditional practices.

Past uranium mining and exploration had an adverse effect on the Mt. Taylor Traditional Cultural Property and sacred site. There is a proposal to continue mining on private property within the boundary of the Mt Taylor Traditional Cultural Property. Existing permitted activities or facilities located on traditional cultural properties and or sacred sites on the national forests within New Mexico are expected to continue.

The Hopi Tribe and the Pueblo of Zuni have verbally stated through letters to the Secretary of Agriculture that the Forest Service is incrementally damaging or destroying traditional cultural properties and sacred sites that are important and vital to maintain the physical and spiritual survival of the tribes. Sacred sites are interconnected and are part of the spiritual and traditional landscape. Although, the no-action alternative and the action alternatives are not expected to have a cumulative adverse impacts on the access and use of Cibola lands and resources for traditional practices, potential mining activities, congressional acts and Cibola authorized land adjustments and special use permits that could occur have the potential to contribute to cumulative adverse effects on the availability and continuation of traditional uses, practices, and cultural identity.

Opportunities for Solitude and Privacy for Tribal Traditional and Cultural Activities

The no-action alternative and action alternatives are not expected to contribute to cumulative adverse effects on opportunities for solitude and privacy for traditional cultural activities. The 2012 Bureau of Land Management Rio Puerco draft resource management plan states this resource area will designate approximately 232,000 acres as extensive recreation management areas or as special recreation management areas. Bureau of Land Management Rio Puerco Office staff specifically note the designation of these two areas could increase user conflicts in these designated areas and reduce the solitude and privacy of tribal members while engaging in traditional cultural or religious activities (USDI Bureau of Land Management 2012). However, Rio Puerco Field Office personnel will also designate seven areas of critical environmental concern for the protection of cultural resources or which will provide additional protection for cultural resources. These areas of critical environmental concern will total between approximately 25,000 and 53,000 acres. Traditional cultural or religious practices occur in some of these areas, and these designations may increase opportunities for solitude and privacy for tribal members (USDI Bureau of Land Management 2012).

The 2010 Socorro Bureau of Land Management resource management plan identifies the creation of 2 areas of critical environmental concern for the protection of cultural resources, and four special management areas for the protection of cultural resources. One of these, the Zuni Salt Lake proprietary area of critical environmental concern (approximately 47,000 acres) is one where traditional cultural or religious activities is likely to occur, and management direction for this area will increase opportunities for solitude and privacy for tribal members (USDI Bureau of Land Management 2010).

Cultural and Historic Resources

The plan area contains cultural resources that demonstrate human occupation and use for approximately the past 12,000 years. The occupation and use of the plan area by Native Americans (American Indians) with Pueblo and Athabaskan ethnic affiliation and groups ancestral to these ethnic affiliations has occurred over this entire time span. Occupation and use of the plan area by Euro-Americans and other peoples from the Old World has occurred over approximately the past 400 years.

The plan area has been under the management of the USDA Forest Service beginning in 1906 or for a little more than 100 years. Native American, Hispanic, and Anglo-American traditional communities continue to use the plan area for economic, social, and religious purposes (See "Traditional Communities and Uses" section). Additional information on cultural resources can be found in volume II of the assessment report prepared in support of the land management plan (USDA Forest Service 2015b).

Cibola National Forest meets its obligations under the National Historic Preservation Act through the Forest Service Region 3 first amended programmatic agreement (USDA Forest Service 2010c). Federal undertakings that may result in an adverse effect on historic properties are resolved as stipulated the programmatic agreement. The Archeological Resources Protection Act of 1979, as amended, provides enforcement and legal remedies for all unauthorized removal of archaeological resources from Federal land.

Affected Environment

Cibola National Forest is rich in historically and culturally significant properties. As of December 2012, approximately 210,400 acres are considered to have been inventoried to current standards, or 13 percent of the total plan area. Inventory has not been conducted evenly across the four districts, or within each district. (USDA Forest Service 2013b). A total of 4,991 cultural resources have been recorded in the plan area as of December 2012. (USDA Forest Service 2015b). The density of sites varies widely across the four districts due to a variety of factors. On average, the 2013 review found 12.21 sites per every square mile surveyed. The majority of the sites are recorded between 7,000 and 8,000 feet in elevation. Approximately one-third of the recorded sites date to A.D. 1600 or earlier; one-third to after A.D. 1600; and the remaining third are of unknown age.

Historic properties are defined under section 101 of the National Historic Preservation Act 54 U.S.C. section 300308 as any district, site, building, structure, or object included on, or eligible for inclusion on, the National Register of Historic Places, based on their importance to local, regional, or national history. There are five designated and listed historic properties in the plan area. Two historic properties have been designated national historic landmarks for their significance in the history of the United States. Big Bead Mesa, the remains of an 18th century Navajo settlement, is located on the Mount Taylor division of the Mount Taylor Ranger District. Sandia Cave, a Paleoindian site of ceremonial and religious significance, is located on the Sandia Ranger District.

In addition to the two national historic landmarks, there are three additional properties listed on the National Register of Historic Places. The Southwestern Sheep-Breeding Laboratory Historic District is a twentieth century USDA experiment station located on the Zuni division of the Mount Taylor District. Gallinas Springs is the remains of a fourteenth century Pueblo village of the Mesa Verde tradition located on the Bear division of the Magdalena District. Tijeras Pueblo is the remains of a fourteenth and fifteenth century Pueblo village of the Rio Grande tradition located on the Sandia District.

Of the 4,991 cultural resources recorded in the plan area, only slightly less than half have been evaluated for their eligibility for listing on the National Register of Historic Places. The high number of properties that have been recorded but not evaluated is a legacy of past practices. Prior to 1995, the Forest Service in the Southwestern Region did not consistently make eligibility evaluations. Of the properties that have been evaluated, slightly less than one-third have been determined eligible or are listed on the National Register of Historic Places. Slightly more than a quarter of the resources have been determined not eligible for the National Register. The remaining evaluated properties did not receive determinations of eligibility, either because the agency felt that more investigation of the property was needed for a determination of National Register eligibility to be made, or because Forest Service personnel and the New Mexico state historic preservation officer in consultation could not agree on the eligibility determination. For management purposes, the Forest Service personnel treat undetermined and unevaluated properties as if they are eligible to the National Register of Historic Places until a determination of eligibility can be made.

Traditional cultural properties are a subset of historic properties. Traditional cultural properties are historic properties that are in the main or in part eligible to the National Register of Historic Places because of their "association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community (Parker and King 1998)."

Data on current conditions and trends for historic properties can be examined from the recording and monitoring of historic properties over the past 50 years. Water erosion, and other forms of erosion, is the most common source of damage, noted at over one third of all property visits, but at most properties, it is not a severe impact. Land development impacts, including logging, mining, road construction, and other activities, was observed at just less than one-fifth of all property visits, and is often severe. Bioturbation, which includes impacts from cattle grazing in addition to damage from rodents, insects, and other wildlife, was noted during about one eighth of all visits. Vandalism, a category that includes looting, the defacement of standing structures and other features (such as rock art), arson, and the collection of surface remains, is the least prevalent disturbance category noted during visits, having been observed during just less than six percent of the time during recording events (USDA Forest Service 2015b).

Environmental Consequences

Almost all land and resource management activities have the potential to affect cultural resources. The potential effects of individual actions on cultural resources will be evaluated under section 106 of the National Historic Preservation Act and the National Environmental Policy Act. Adverse effects from planned undertakings are very rare and will continue to be exceptional under all alternatives. None of the action alternatives contemplate an increase in undertakings that would result in an adverse effect on historic properties under section 106 or significant impacts on cultural resources under the National Environmental Policy Act. As such, the greatest threats to cultural and historic resources affected by programmatic planning are those activities not initiated by agency actions: wildfire, looting, vandalism, and dispersed recreation (recreation outside of established recreation areas). These threats are not evaluated or mitigated under the section 106 process.

Nonmotorized Dispersed Recreation Activities

Activities associated with nonmotorized dispersed recreation can affect cultural resources by threatening the integrity of structures and sites. The impacts include ground disturbance, erosion, site looting, vandalism, modern disturbances, or a combination of these things. Structures, sites, and areas can be damaged by nonmotorized dispersed recreation, both associated with the use of designated trails and with off-trail use (Nisengard 2008). Looting, in particular, at sites today tends to take place in areas that are away from roads and developed facilities to avoid discovery. Increasing dispersed nonmotorized recreation can both aid in identifying these activities, and by increasing backcountry traffic, discouraging looting as well.

Indicator

- Change in acres within recreation opportunity spectrum categories to primitive and semi-primitive nonmotorized

Assumptions

- Emphasizing nonmotorized dispersed recreation increases the risk of impacts from ground disturbance, unauthorized collecting, vandalism, and environmental impacts such as increased erosion from these activities (Spangler 2008).
- Emphasizing nonmotorized dispersed recreation potentially increases the information regarding resource conditions provided to the agency by nonmotorized dispersed recreationists**.**

Motorized Recreation Activity

The draft land management plan makes no changes to the Cibola's travel management plans and will not change effects to cultural and historic resources from dispersed motorized recreation in areas designated for its use. Structures, sites, and areas associated with motorized travel routes—both open system routes and those that are closed or user created—are at elevated risk from surface disturbance and vandalism. Persons who do not obey travel management designations will travel on any passable route. Resources at greatest risk from ground disturbance, vandalism, and unauthorized collecting are generally within a few hundred meters of motorized travel routes (Hedquist et al. 2014, Spangler 2006, Propper 2012).

Indicator

- Miles of system roads or unauthorized routes relocated, improved, or decommissioned

Assumptions

- Decommissioning motorized travel routes, regardless of classification, reduces the risk of ground disturbance, unauthorized collection, and vandalism at structures, sites, and areas near those motorized travel routes**.**

Fire and Post-Fire Impacts

All fire-sensitive and non-fire-sensitive structures, sites, and areas are at risk of loss of integrity from high-intensity, uncharacteristic wildland fire. All structures, sites, and areas are at risk from post-fire effects, primarily flooding in drainages and other forms of water erosion. Not all risks can be mitigated in the burned area emergency response process and only for known structures, sites, and areas. Structures, sites, and areas at risk can be within and outside the area burned, as resources in watersheds downstream from the burn area can be impacted.

Activities associated with wildland fire can affect the integrity of structures, sites, artifacts and areas from wildland fire and connected effects. Common examples of indirect effects include post-fire erosion, carbon contamination in archaeological deposits, disturbances from fire-killed tree fall (Ryan et al. 2012). Fire suppression and burned area emergency response activities (not archeological site protection activities, but other types of burned area emergency response activities, like road and watershed protection, or noxious weed treatment) can adversely affect structures, sites, and areas as an indirect effect of wildland fire. Like burned area emergency response, not all effects from fire suppression can be mitigated through the 36 CFR 800.12 process, as immediate protection of life and property take precedence over resource protection.

Indicators

- Acres of mechanical vegetation treatment, prescribed burning, and wildland fire managed for resource values

Assumptions

- Mechanical treatment of vegetation reduces the threat to structures, sites, and areas within the acres treated by reducing the likelihood of uncharacteristic wildland fire once treatment is completed. There is an elevated threat from wildland fire to structures, sites, and areas within treatment acres while treatment is in progress. Increased acreage of mechanical vegetation treatment can reduce wildland fire threat.
- Prescribed burning reduces the threat to structures, sites, and areas in the acres treated. Increased acreage of prescribed burning during optimal conditions can allow for fire that will not burn as hot as wildland fires and sites can be identified prior to implementation and protected. Increasing the acreage of prescribed burning will protect sites (Buenger 2003).
- Wildland fire managed for resource benefit reduces the threat from catastrophic wildland fire for all non-fire-sensitive structures, sites, and areas and known fire-sensitive structures, sites, and areas. Increased acres of wildland fire managed for resource benefit should reduce fuels and reduce the potential for impacts on heritage resources from uncharacteristic wildfire. However, unknown or unrecorded heritage resources could be impacted by managed wildland fire.
- The Wildland Fire Decision Support System process can be used to manage the potential threat to unknown fire-sensitive structures, sites, and areas where there is a known high site density from wildland fire managed for resource benefit. This knowledge would direct the response so the impact to sites would be reduced (Ryan 2012).
- The fire regime condition class by subwatershed (6th-level hydrologic unit code) analysis should identify in advance which areas are more likely to burn.

Environmental Consequences Common to All Alternatives

Known cultural resources will continue to be subject to further consideration under section 106 of the National Historic Preservation Act, regardless of alternative. These are cultural resources that eligible for listing on the National Register of Historic Places, or undetermined and unevaluated properties that may be eligible for listing on the National Register of Historic Places, known collectively as historic properties.

In most cases, historic properties will be protected during undertakings by being avoided by undertaking activities, or through property-specific mitigations designed to prevent impacts from the undertaking. In cases where there are undertakings that may result in adverse effects to historic properties, adverse effect are resolved as stipulated in the process in 36 CFR 800.6, as described in the Southwestern Region first amended programmatic agreement. Therefore, most properties will be protected during most undertakings through the section 106 process on a case-by-case basis.

All alternatives propose acreage of prescribed fire, wildland fire use, mechanical treatments, road decommissioning, and acres designated for primitive or semi-primitive nonmotorized recreation. These actions may reduce the potential for impacts including but not limited to reducing damage from catastrophic wildfires, protecting sites from erosion, weathering, and neglect, exposing sites to increased visibility, and being destroyed or altered.

Environmental Consequences – Alternative A

Current management would not change for resources eligible for listing on the National Register of Historic Places, the State Register of Cultural Properties, or traditional cultural properties.

Nonmotorized Dispersed Recreation Activities

The 1985 plan defined 672,165 acres that would be considered suitable for primitive or semi-primitive nonmotorized travel. Approximately 41 percent of the Cibola would remain open to primitive or semi-primitive nonmotorized recreation. Dispersed recreation can be associated with impacts from ground disturbance, erosion, unauthorized collecting, and vandalism caused by nonmotorized recreation. Alternatively, recreationists may observe and report impacts on resources in remote areas and assist the forest in monitoring and protecting resources.

Motorized Recreation Activity

Under alternative A, up to 1 mile of system roads or unauthorized routes would be relocated, improved, or decommissioned annually, or up to 10 miles over the next 10 years, to protect ecosystems and watersheds. These undertakings may reduce the potential for ground disturbance, erosion, vandalism, and unauthorized collecting near the affected motorized travel routes segments.

Fire and Post-Fire Impacts

Under the no-action alternative, existing fuel loading and the high risk of a stand-replacing wildfire could have a direct effect on heritage sites. Historic sites with wooden, glass, and other similar components (fire-sensitive sites) would remain at the greatest risk from burning. All sites would remain at risk from increased erosion associated with high-intensity fires. Alternative A would thin or treat 2,000 to 5,000 acres annually, allow 4,000 to 6,000 acres of prescribe burning annually, and manage for resource benefit 10,000 to 20,000 acres of wildfire annually, reducing the potential for high-intensity fires.

Environmental Consequences Common to Alternatives B, C, and D

Alternatives B, C, and D would substantially increase acres of wildland fire that could be managed for resource benefit, and recreation opportunity spectrum acres classified as primitive or semi-primitive nonmotorized over the 1986 plan. Managed wildland fire would generally reduce the potential threat from catastrophic wildland fire on heritage resources, but unknown or unrecorded heritage resources could be impacted by managed wildland fire. Such sites could be damaged or destroyed by burning if they feature fire sensitive elements (wooden structures, rock art, etc.).

Dispersed recreation and nonmotorized recreation can be associated with impacts from ground disturbance, erosion, unauthorized collecting, and vandalism. However, recreationists may observe and report impacts on resources such as looting in remote areas and assist Cibola personnel in monitoring and protecting resources.

All three alternatives will increase at very similar levels the number of sites or areas protected annually and reduce deferred maintenance. This increase would protect more sites than alternative A. These actions would further reduce the potential for adverse effects on historic properties from weathering, erosion, ongoing use at historic properties.

Environmental Consequences – Alternative B

Alternative B focuses on protection and restoration of site-specific resource management areas. As such, alternative B includes additional direction related to heritage resources, traditional cultural properties, and culturally significant tribal and traditional resources that would result in improved management and protection from incompatible activities.

Alternative B would propose management areas that would enhance and protect culturally significant sites and areas through site-specific plan direction to address cultural, traditional, and contemporary uses, as well as develop interpretation: Las Huertas, Pueblo Migration, Ft. Wingate Sheep Laboratory Historic Site, Cement Springs Civil War Historic Site, and Jumanos Pueblos.

The Fort Wingate Management Area would provide additional protection to the Southwestern Range and Sheep Breeding Laboratory Historic District by increasing opportunities for cooperating partners to preserve and interpret the historic district.

Greater protections limit the types of activities that can be authorized in the area. Although all proposed projects that will use this document as a reference will be subject on a case-by-case basis for the protection of heritage resources, limiting types of activities in areas adds another layer of protection in addition to section 106 of the National Historic Preservation Act.

In addition to improved protection, site-specific plan direction could include interpretation of historic sites, preparation of educational materials related to the sites (published physically or on the web), preparation of heritage tourism brochures, and other beneficial interpretive products. Interpretation of historic sites enhances the public's enjoyment and increases the likelihood of site protection from looting and vandalism as members of the public become stakeholders in site preservation (Moe 2015).

Nonmotorized Dispersed Recreation Activities

Alternative B proposes 677,653 acres of desired primitive and semi-primitive nonmotorized recreational opportunities which is approximately 5,488 more acres than alternative A. Although such a small increase (less than 1 percent) is not significant, increased dispersed recreation and nonmotorized recreation can be associated with more potential impacts from ground disturbance, erosion, unauthorized collecting, and vandalism. However, recreationists may observe and report impacts on resources in remote areas and assist Cibola personnel in monitoring and protecting resources.

Motorized Recreation Activity

Alternative B calls for relocating, improving, or decommissioning up to five miles per year or up to 50 miles over the next 10 years of system roads or unauthorized routes. Alternative B would reduce the potential for ground disturbance, erosion, vandalism, and unauthorized collecting near the affected motorized travel routes segments more than alternative A.

Fire and Post-Fire Impacts

Alternative B would reduce existing fuel loading and the high risk of a stand-replacing wildfire. Alternative B would treat the same number of acres mechanically as alternative A but would increase acres of prescribed burning by 1,000 to 2,000 more acres annually, and managed wildfire by 8,000 to 16,000 more acres annually over alternative A. Alternative B would result in a faster ecological restoration by reducing fuels across cultural resources coupled with a comparatively lower risk of high-intensity fire across the landscape.

Environmental Consequences – Alternative C

Alternative C creates larger broad-based restoration management and conservation management areas that would emphasize intensive management across multiple resources areas. In the restoration management areas, restoration methods would be focused on managed fire use, road removal or relocation and mechanical thinning to reduce fire hazard and protect infrastructure on high-priority areas near roads, entry points, and forest boundaries. In the conservation areas, the emphasis would be primitive, unconfined, and backcountry types of recreation and provide opportunities for solitude and protect high-value natural and tribal cultural resources.

Nonmotorized Dispersed Recreation Activities

Alternative C proposes 673,247 acres of desired primitive and semi-primitive nonmotorized recreational opportunities which is approximately 1,082 more acres than alternative A. Although this is a nominal increase, increased dispersed recreation and nonmotorized recreation can be associated with more potential impacts from ground disturbance, erosion, unauthorized collecting, and vandalism. However, recreationists may observe, and report impacts on resources in remote areas and assist Cibola personnel in monitoring and protecting resources.

Motorized Recreation Activity

Alternative C calls for relocating, improving, or decommissioning up to five miles per year or up to 50 miles over the next 10 years of system roads or unauthorized routes. Alternative C would reduce the potential for ground disturbance, erosion, vandalism, and unauthorized collecting near the affected motorized travel routes segments more than alternative A.

Fire and Post-Fire Impacts

Alternative C would reduce existing fuel loading and the high risk of a stand-replacing wildfire by thinning or treating approximately 2,800 to 7,000 acres of dry mixed conifer annually. Alternative C would allow for approximately 2,000 to 3,000 more acres to be treated with prescribed fire annually than alternative A. Managed wildfire for resource benefit would increase 6,000 to 10,000 more acres annually than alternative A.

Alternative C has the highest percentage of thinning and prescribed burn acres proposed of the alternatives. Alternative C would result in the most rapid ecological restoration by reducing fuels across historic sites, coupled with a comparatively lower risk of high-intensity fire across the landscape.

Environmental Consequences – Alternative D

Alternative D prescribes less intensive management and places an emphasis on backcountry resources and experiences. More wilderness is recommended than any of the other alternatives and the intent is to provide more solitude, remoteness while accepting more risk across larger areas.

A wilderness area would provide additional protection to portions of the Big Bead Mesa National Historic Landmark, while simultaneously giving attention to the area. There are more recommended wilderness areas than the other alternatives. While these are not designated to protect specific heritage resources, this management would limit many incompatible activities,

Wilderness creates a unique situation for heritage resources. Dispersed recreation can be associated with impacts from ground disturbance, erosion, unauthorized collecting, and vandalism caused by nonmotorized recreation. Alternatively, recreationists may observe and report impacts on resources in remote areas and assist the forest in monitoring and protecting resources. In general, however, wilderness areas preserve characteristics that contribute to the integrity of heritage resources-preserving location, feeling, and association.

Nonmotorized Dispersed Recreation Activities

Alternative D proposes 709,413 acres of desired primitive and semi-primitive nonmotorized recreational opportunities which is approximately 37,248 more acres than alternative A. This significant increase (5.5 percent) in acres from alternative A is likely to lead to increased potential impacts from ground disturbance, erosion, unauthorized collecting, and vandalism. However, recreationists may observe and report impacts on resources in remote areas and assist Cibola personnel in monitoring and protecting resources.

Motorized Recreation Activity

Alternative D calls for relocating, improving, or decommissioning up to 3 miles per year or up to 30 miles over the next 10 years of system roads or unauthorized routes. Alternative D could reduce the potential for ground disturbance, erosion, vandalism, and unauthorized collecting near the affected motorized travel routes segments more than alternative A.

Fire and Post-Fire Impacts

Alternative D could reduce existing fuel loading and the high risk of a stand-replacing wildfire. Alternative D would treat the same number of acres mechanically as alternative A but would increase acres of prescribed burning by 1,000 to 2,000 more acres annually, and managed wildfire by 10,000 to 20,000 more acres annually over alternative A. Alternative D would result in a faster ecological restoration by reducing fuels across cultural resources coupled with a comparatively lower risk of high-intensity fire across the landscape.

Cumulative Environmental Consequences

Monitoring data indicate project activities, such as those related to mechanical treatment, prescribed burns, and increases in dispersed nonmotorized recreation, may result in unplanned or inadvertent adverse impacts such as ground disturbance, erosion, unauthorized collecting, and vandalism to cultural resources in rare cases. Such unplanned or inadvertent adverse impacts are addressed and mitigated on a case-by-case basis. In almost all cases, incidental unplanned or inadvertent impacts from the implementation of undertakings are almost always more than offset by the benefits of ecological restoration to the long-term protection of cultural resources resulting from the undertakings.

Adjacent planning efforts (Bureau of Land Management, counties) do not indicate any cumulative effects to cultural resources. Bureau of Land Management "rule of reason" may require cultural resources survey on National Forest System lands when associated with a project on Bureau of Land Management lands, but the survey itself would not have cumulative effects. Pipelines and oil and gas wells could have an adverse effect, such as site destruction, unauthorized collecting, and erosion, but will be managed through the section 106 process on a case-by-case basis.

Minerals and Geology[38]

The Cibola host occurrences of important mineral resources. Minerals are important as a raw materials source; they are useful in a native or refined state. As economic and political conditions fluctuate, certain mineral commodities can become more valuable, prompting new or renewed interest in prospecting, exploration, and mining of these minerals. Management of mineral activities on the Cibola is carried out to facilitate the development of mineral resources and contribute to local, national, and global markets for valuable commodities.

The purpose of the Cibola minerals and geology program is to provide appropriate access to mineral resources in accordance with the mining laws; while facilitating mineral development in a manner that minimizes adverse impacts to surface resources. This follows law and Forest Service policy to support responsible, environmentally sound energy and mineral development and reclamation (30 U.S.C. 21a). Minerals are not a sustainable forest resource. Once a mineral resource is removed, it is no longer available. However, a major function of the minerals and geology program is to ensure reclamation of surface resources impacted by mining is completed to the extent possible. The restoration of areas that have experienced mineral activity impacts is an obvious contribution to the sustainability of other forest resources. For more a detailed discussion of the minerals and geology program, see the Cibola National Forest assessment report, volume 2 (USDA Forest Service 2015b).

How minerals may be searched for or acquired on National Forest System lands is prescribed by Federal law and mineral category. Valuable mineral resources on the Cibola range from soil for making adobes and limestone for cement to rare earth minerals used in high-tech applications, such as battery-operated cars and aerospace components, to uranium as an energy fuel in itself.

Locatable, Leasable, and Salable Minerals

There are three categories of minerals, known as **locatable**, **leasable**, and **salable** minerals; each is subject to different Federal laws and implementing Forest Service regulations. Most importantly this affects whether Forest Service personnel have the discretion to refuse some types of proposed mineral operations. To some extent, this also affects how operations can be administered by Forest Service personnel. For this reason, the three categories of mineral resources are described separately below and the plan components for each are addressed separately.

[38] Minerals refers to extractive mineral operations, while geology refers to geologic features and the enjoyment and scientific study of these features.

Locatable Minerals

Background and Description

Locatable minerals are defined as types of minerals that fall under legal mandates requiring that the Forest Service provide reasonable access for prospecting, mining, and processing activities. Minerals subject to the 1872 Mining Law, as amended, are obtained by locating a mining claim. These locatable minerals include metals, for example gold, silver copper, or uranium. According to Federal mining laws, for locatable minerals, Forest Service personnel are required to respond to proposals for conducting prospecting, mining, or processing operations for locatable minerals. For locatable minerals, Forest Service personnel do not have the authority to outright deny locatable mineral activities providing the operations follow applicable laws and regulations. This is because staking a mining claim gives the claimant ownership of the minerals. The agency role in managing such resources is to provide reasonable protection of surface resources, and to lessen any adverse impact of mineral extraction and processing (30 U.S.C. 21a). When receiving a proposed plan of operation for locatable minerals, Forest Service personnel must determine whether to approve the preliminary plan of operations as submitted or to require changes or additions deemed necessary to meet the requirement of the regulations for environmental protection. All proposals must comply with Federal laws and regulations, and should be managed to reduce adverse environmental impacts to the extent practicable on National Forest System lands.

Reclamation on the Cibola goes hand-in-hand with locatable mineral activities and operations. Each operation has a reclamation component which is site-specific and tied to that single operation. For example, appropriate reclamation is discussed with operators for small sluicing operations as well as required in plans of operation for mining. In locatable minerals mining, full reclamation may not always be possible. For example, when ore or waste rock material is removed from a mine site, there may be resulting pit(s) or piles of material formed. If this cannot be avoided to remove the minerals (mine the site), the operator may not be required to return the site to its original contours, if that is not possible. Forest Service personnel can accept a reclamation plan which will return the site to natural appearance to the nearest extent possible. It is the responsibility of the operator to reclaim mineral activity sites as authorized in their plan of operation. In addition to plans of operation, bonds collected by Forest Service staff insure money is available for site reclamation, should the operator default on the work. Should the operator default on the obligations, the bond is used to complete the reclamation work. Otherwise, the bond is held until the work is completed by the operator. It will be returned once satisfactory reclamation is completed.

Affected Environment

Locatable Minerals

The potential for locatable minerals within the boundaries of the Cibola is high because the geology of the mountain areas is such that the forces from mountain-building and the types of rocks involved acted together to create the many mineral occurrences present. The mountain ranges expose mineralized zones in a number of places. The Mount Taylor Ranger District includes an area of world-class uranium deposits which were widely explored and mined during a period of previous mining from the 1950s through the late 1970s. In an area of known deposits, interest for exploration and mining of the mineral resource is expected to continue. There are also uranium deposits on the Magdalena Ranger District.

The Mountainair Ranger District is an area of known mineralization of important rare earth elements (known as REE). The Gallinas Mountains have been identified as one of the principal rare earth elements deposits of the United States (Van Gosen et al. 2017). These rare earth elements minerals are currently 100 percent obtained from outside the United States, principally from China. Rare earth elements are identified on the current listings of critical minerals of the U.S. (Federal Register January 2018). There are areas of historic gold and silver mining on all of the districts. Interest in these mineral areas continues as gold panning has been increasingly popular. It is expected the "small miner" interest will continue. Whether it is considered recreational by some or subsistence mining by others, it is important to note all these operations are locatable minerals and whether small or large, are regulated by the same regulations at 36 CFR 228.4, and under the U.S. mining laws.

Leasable Minerals

Leasable minerals area a category of mineral resources sold by lease. Leasable minerals are the hydrocarbon-based resources including oil, gas, and coal, also geothermal, and certain other solid minerals such as phosphate, potassium, sodium. Also, minerals usually locatable are administered as leasable on lands acquired under the Weeks Law (16 U.S.C. 520).

The Cibola does not have the geologic environment in the mountain districts to host conventional oil and gas resources or solid leasable minerals. Geologically, oil shale or tar sand deposits could potentially occur in the southern San Juan Basin on the Mount Taylor Ranger District. Those resources are not recoverable with conventional technology. There are coal exposures in many locations throughout the mountain districts; however, they occur in such small volume they are not of economic interest. The potential for leasable minerals is low, and no management of leasable minerals is anticipated for the plan area. However, should mineral leasing be proposed, the Forest Service role in managing leasable resources is to recommend or consent to the Bureau of Land Management, whether leases for these commodities should be issued and specify any surface resource protection that may be needed. Stipulations to protect surface resources would be made for exploration, well production, or mining.

Salable Minerals or Mineral Materials

Salable minerals as a term is synonymous with mineral materials and can also be called common varieties. Mineral materials are common minerals sold at the discretion of Forest Service staff. Salable minerals, or mineral materials, refer to lower-value, common variety materials such as rock, gravel, sand and dirt. Forest Service personnel have the authority to decide whether to sell these mineral materials and where.

Mineral materials, obtained by personal-use permit or contract, provide a number of products that are valuable and often used or sold locally. For example, dirt and clay can be used for traditional adobe construction and rock rubble for foundations and wall construction. Moss rock used for landscaping rock is very popular on the Cibola. Personal-use permits may be obtained to gather minerals such as rock, boulders and borrow in designated areas. Salable minerals for personal use are sold on a permit system. Commercial rock sales are sold by mineral material contract and may require a bid sale to offer an area to multiple bidders.

Environmental Consequences

Most of the direction that affects mineral activities is reflected in the land management plan but comes from the U.S. mining laws and the surface use regulations at 36 CFR 228. Minerals are a nonrenewable resource. Indicators for minerals are acres that quantify opportunities lost or available to access mineral resources. Withdrawn areas are acres of any potential mineral resources lost to availability. Existing wilderness designations on the Cibola total 138,378 acres withdrawn from location and entry (table 34). Acres lost to mineral development opportunity do, however, remain undisturbed by mineral-related activity. Reclamation of mineral operations sites are required to be returned to previous conditions to the extent possible.

For locatable minerals, known mineralized acres are of higher mineral resource value than acres of unknown mineral potential. Not all mineralized areas are known. Acres designated as wilderness areas are permanently removed from any option to explore for, and find, valuable minerals. When mineralized areas are identified and are of significance, such as in the Gallinas Mountains, the location of that mineralized area becomes an important indicator all on its own. The Cibola National Forest assessment report, volume 2 (USDA Forest Service 2015b) indicates known mineral potential in a very broad sense.

For leasable minerals, this analysis does not identify areas available for lease and is not a lease analysis under 36 CFR 228, subpart E. The plan area has no areas geologically suited for conventional leasable minerals. The geological environment and the processes which produce the leasable mineral resource are absent. These metrics are provided solely for the purpose of identification and comparison of acres which would not be legally open (available) for leasing due to wilderness designation. The consequences of leasable mineral resources lost to development in wilderness is zero.

For salable minerals, acres lost to development is also used as a comparison, but a metric would have to be estimated be evaluated in number of permits and or contracts sold. Common minerals are less likely to be removed from remote areas, such as those nominated for wilderness. This is because most common minerals are available in areas more easily assessable. Extra gas and haulage is a factor in removing more remote mineral materials. The consequences of salable mineral resources lost in wilderness development is low.

Impact Indicators for Mineral Resources

- For locatable minerals, the acres permanently removed from availability under the 1872 Mining Law, as amended (the U.S. mining laws).
- For leasable minerals, the acres removed from availability to be nominated for leasing.
- For salable minerals, the acres removed from the availability for sale or free use of mineral materials and number of permits and contracts sold.

Assumptions

- On Federal land, all areas are open and available for locatable minerals except areas withdrawn from the operation of the 1872 Mining Law, as amended. Mining can occur in withdrawn areas, but only subject to valid existing rights Forest Service personnel have no discretion over allowing the development of locatable minerals, only that operations are conducted according to the regulations at 36 CFR 228.A.
- Future level of interest for locatable minerals on the mountain districts, particularly on the Mount Taylor, Magdalena, and Mountainair Ranger Districts, is expected to increase over time. There is expected to be increasing interest in exploration for and development of locatable minerals to support local, national, and global technological needs.
- Should leasable minerals be identified in the plan area, a leasing analysis under 36 CFR 228, subpart E would be conducted to evaluate the availability of areas.
- Future level of interest for salable minerals on the Cibola is expected to increase over time to meet local and national needs for building and decorative uses.

Environmental Consequences – Alternative A

Locatable

Under the no-action alternative, an existing 138,378 acres of designated wilderness continue to be withdrawn from location and entry under U.S. mining laws (30 U.S.C. 22, 28, 28b). There would be no change in the number of acres open for exploration and development of locatable mineral resources. Areas open to mineral exploration and development would continue to be open for potential discovery and development of valuable mineral resources.

Leasable

There would be no change in the number of acres potentially available to be nominated for leasing of mineral resources under the no-action alternative. The plan area has no known areas that are geologically suited for conventional leasable minerals. The geological environment and the processes which produce the leasable mineral resource are absent. These metrics are provided for the purpose of analysis only. Future identification of leasable minerals in the project area would require a lease analysis under 36 CFR 228, subpart E. Forest Service personnel have discretion to consent or not to consent to a Bureau of Land Management proposal to lease an area for the development of leasable resources. Alternative A has no consequences for leasable mineral resources.

Salable Minerals and Mineral Materials

Under alternative A, nonwilderness acres remain open for salable mineral sales, which may have potential for development of mineral materials. There would be no change in the number of acres potentially available for the sale or free use of mineral materials under the no-action alternative. Alternative A has no change in consequences for salable mineral resources. Forest Service personnel have complete discretion whether to offer or allow mineral material disposals. Because of this, it is not generally identified by land status specifically where mineral material sales are not allowed (other than wilderness), as the local unit staff can make that decision. With no change in emphasis on mineral material production, either increasing or decreasing, it is projected that sales would be flat. Typically, there are less than 10 permits sold per year on average.

Environmental Consequences – Alternative B

Locatable

The biggest contrast to the no-action alternative are the recommended wilderness acres if they were to become designated wilderness. Alternative B would recommend 55,779 new wilderness acres. These lands would be withdrawn from location and entry under U.S. mining laws, and there would be a permanent removal of an additional 55,779 acres available for locatable mineral development if designated by Congress. Alternative B would withdraw 53,235 acres on Magdalena Ranger District and 2,544 acres on Mountainair Ranger District. If the lands eventually become wilderness, potential mineral resources in these areas would not be available to contribute to or facilitate the development of valuable mineral resources and contribute to local, national, and global markets for valuable commodities. Additionally, withdrawn acres would not likely be available for future scientific study of minerals, as mechanized equipment and motorized access would be prohibited.

Leasable

Under alternative B, there would be a reduction of 55,779 acres potentially available to be nominated for leasing of mineral resources, based on acres of recommended wilderness. The plan area has no known areas geologically suited for conventional leasable minerals.

Salable Minerals and Mineral Materials

Under alternative B, due to the recommended addition of wilderness, there would be a reduction of 55,779 acres potentially available for exploration and development of salable mineral resources. This is not a large impact to salable minerals because generally these minerals occur in abundance throughout the Cibola, whether in mountainous areas or not. Forest Service personnel have discretion to offer or allow mineral material disposals. Although there is likely growth in permit sales due to growing demand, plan direction under alternative B may result in fewer mineral material permits or contracts than alternative A.

Environmental Consequences – Alternative C

Locatable

Alternative C would recommend an additional 24,265 acres as wilderness. These lands would be withdrawn from location and entry under U.S. mining laws, and there would be a permanent removal of 24,265 acres available for locatable minerals if designated by Congress. Of the action alternatives, alternative C would have the least impact on the availability of locatable minerals with 24,265 new acres withdrawn for wilderness. Alternative C would withdraw 22,945 acres on Magdalena Ranger District, and 1,320 acres on Mountainair Ranger District. If the lands eventually become wilderness, potential mineral resources in these areas would not be available to contribute to or facilitate the development of valuable mineral resources and contribute to local, national, and global markets for valuable commodities. Additionally, withdrawn acres would not likely be available for much future scientific study of minerals, as mechanized equipment and motorized access would be prohibited.

Leasable

Under alternative C, there would be a reduction of 24,265 acres potentially available to be nominated for leasing of mineral resources, based on acres of recommended wilderness. Additionally, a corridor of ¼ mile on either side of the Continental Divide National Scenic Trail would be specified as removed from leasing under this alternative. The plan area has no known areas that are geologically suited for conventional leasable minerals.

Salable Minerals and Mineral Materials

Under alternative C, due to the recommended addition of wilderness, there would be a reduction of 24,265 acres potentially available for exploration and development of salable mineral resources. This is not a large impact to salable minerals because generally these minerals occur in abundance throughout the Cibola. Forest Service personnel have discretion to offer or allow mineral material disposals. Although some acres are removed from development in wilderness, plan direction under alternative C may result in an increase in the number of areas opened for mineral material sales due to an emphasis on forest product utilization. Personal use permits and or contracts may be sold in increased numbers, to average as many as 45 permits per year. This forest product could provide more raw materials to the public for construction, landscaping, and road and highway construction materials to State and local entities.

Environmental Consequences – Alternative D

Locatable

Alternative D would recommend an additional 203,117 acres as wilderness. These lands would be withdrawn from location and entry under U.S. mining laws, and there would be a permanent removal of 203,117 acres available for locatable minerals if designated by Congress. Alternative D would recommend the most acres for new wilderness at 203,117 acres. The recommended new wilderness areas in alternative D are larger than the already existing total Cibola wilderness areas of 138,378 acres.

Under alternative D, wilderness would be recommended from the four ranger districts in the plan area:

- Sandia Ranger District, 281 acres
- Mount Taylor Ranger District, 27,348 acres
- Magdalena Ranger District, 166,025
- Mountainair Ranger District, 9,463 acres

For all these areas, if the lands eventually become wilderness, potential mineral resources in these areas would not be available to contribute to or facilitate the development of valuable mineral resources and contribute to local, national, and global markets for valuable commodities. Additionally, withdrawn acres would not likely be available for much future scientific study of minerals, as mechanized equipment and motorized access would be prohibited.

The Gallinas Mountain Unit for recommended wilderness is of special significance. The recommended wilderness unit, located on the Mountainair Ranger District, is an area of known mineral occurrence of important rare earth elements. If the Gallinas Mountain recommended wilderness was eventually declared wilderness, 1,224 acres would be withdrawn from the operation of the mining laws. This would preclude further exploration for important rare earth elements, a series of minerals in the Lanthanide Series of the periodic table. Rare earth elements are listed as critical elements of the U.S., and they are valuable for use in high-tech applications such as battery-operated cars and aerospace components. The minerals are identified as critical in terms of energy, industrial, military defense, and emerging alternative energy applications. In addition, rare earth elements are also formally identified as international strategic minerals (Federal Register 2019). There could be significant consequences to the availability of important U.S. and international mineral resources if wilderness were designated in the Gallinas unit and access would be cut off not only to the exploration and development of these minerals, but to conduct important scientific research into the genesis and occurrence of these minerals.

Withdrawal of this area would prevent the access to study the rare minerals. In the case of withdrawal, the scientific knowledge which could be gained would not be applied to locate deposits of rare earth elements elsewhere, affecting the broader availability of rare earth elements. Further studies of the rare earth element occurrence in the Gallinas Mountains would not contribute to knowledge about mineral deposits in general. The Mining and Minerals Policy Act of 1970 directs that the policy of the U.S. Government is to foster and encourage "…the orderly and economic development of domestic mineral reserves", "to help assure satisfaction of industrial, security and environmental needs". The act also directs continuing "mining, mineral, and metallurgical research" which would be ended in this area by enacting a wilderness which prohibited access. The Mining and Minerals Policy Act of 1970 would not be met for these acres if withdrawn as wilderness in alternative D.

The additional wilderness areas proposed for the Sandia Ranger District (281 acres), Mount Taylor Ranger District (27,348 acres), and Magdalena Ranger District, (166,025 acres), and the remaining Mountainair acres (8,239 acres not in the Gallinas Mountains) would total 201,893 acres. These lands would be withdrawn from location and entry under U.S. mining laws, and there would be a permanent removal of acres available for locatable mineral exploration and development. These acres would not be available to contribute to or facilitate the development of valuable mineral resources and contribute to local, national, and global markets for valuable commodities.

Leasable

Under alternative D, there would be a reduction of 203,117 acres potentially available to be nominated for leasing of mineral resources, based on acres of recommended wilderness. The plan area has no known areas that are geologically suited for conventional leasable minerals.

Salable Minerals and Mineral Materials

Under alternative D, due to the recommended addition of wilderness, there would be a reduction of 203,117 acres potentially available for exploration and development of salable mineral resources. Salable minerals occur in abundance throughout the Cibola National Forest, but there would be a large reduction of mineral materials that would be available in the local areas. Forest Service personnel have discretion to offer or not allow mineral material disposals. Based on the conservation emphasis of alternative D, plan direction may result in fewer mineral material permits or contracts, potentially remaining the same as the alternative A, under 10 permits per year.

The Gallinas unit recommended wilderness would remove 2,410 acres where important mineralization is known to occur in the Gallinas Mountains. Not all areas contain valuable minerals. However, because wilderness is often designated in high and inaccessible mountain areas, alternative D may have a disproportionately negative impact on areas containing valuable locatable minerals. This is because the geologic processes that form mountainous areas are often processes necessary to concentrate valuable mineral resources. As a result, although the proposed wilderness areas are only a fraction of the entire plan area or each district, they represent an important percentage of areas mineralized, particularly by locatable minerals. A wilderness designation would be a permanent loss of acres potentially valuable for mineral resources which could have contributed to local, national, and global markets. A related, but indirect, impact affecting minerals is that research efforts can be cut off when areas are closed to access. Both the physical access (using roads) and the use of mechanized equipment to drill or conduct geophysical surveys and identify mineral resources for scientific purposes would not be possible. Even access to areas with marginal mineral resource values (for mining) is critical. Studying the occurrences of minerals is important to inform where important mineral resources may be found elsewhere.

Table 34. Summary of new and existing wilderness acres and potential mineral permits by alternative

Alternative	Locatable Minerals	Leasable Minerals	Salable Minerals
A	0 new wilderness acres (138,378 acres existing wilderness). Remaining acres are open to locatable mineral development unless withdrawn. Removal of minerals is a loss of a nonrenewable resource but is in conformance to minerals law and Forest Service policy.	0 new wilderness acres, (138,378 acres existing wilderness) No effect since there is no geologic environment suitable for leasable minerals	0 new wilderness acres, (138,378 acres existing wilderness). Approximately 10 mineral material permits per year. All nonwilderness acres remain open for salable mineral sales, and may have potential for development. Sale of mineral materials is discretionary. Likely there will be no change in number of mineral permits per year. Because these are personal use permits, there would be a continuing miniscule effect of pickup traffic (one truck per permit with a maximum of four trips each pickup) on existing forest roads. Removal of mineral materials is loss of a non-renewable resource, but a service to the public in conformance to minerals law and Forest Service policy.
B	55,779 recommended wilderness acres. Remaining acres are open to locatable mineral development unless withdrawn. Removal of minerals is a loss of a nonrenewable resource but is in conformance to minerals law and Forest Service policy.	55,779 acres recommended wilderness. Little effect since there is no geologic environment for leasable resources.	55,779 recommended acres. Potentially 20 mineral material permits per year. Because these are personal use permits, there would be a continuing miniscule effect of pickup traffic (one truck per permit with a maximum of four trips each pickup) on existing forest roads. Removal of mineral materials is loss of a nonrenewable resource, but a service to the public in conformance to minerals law and Forest Service policy.

Alternative	Locatable Minerals	Leasable Minerals	Salable Minerals
C	24,265 recommended wilderness acres. Remaining acres are open to locatable mineral development unless withdrawn. Removal of minerals is a loss of a nonrenewable resource but is in conformance to minerals law and Forest Service policy.	24,265 acres recommended wilderness. Little effect since there is no geologic environment for leasable resources	24,265 acres recommended wilderness. Potentially 45 mineral material permits per year. Because these are personal use permits, there would be a continuing miniscule effect of pickup traffic (one truck per permit with a maximum of four trips each pickup) on existing forest roads. Removal of mineral materials is loss of a nonrenewable resource, but a service to the public in conformance to minerals law and Forest Service policy.
D	203,117 acres recommended wilderness acres, Gallinas Mountains: loss of important rare earth elements mineral resource and scientific study of rare earth elements (1,224). Loss of other ranger districts mineral resources (201,893). Remaining acres are open to locatable mineral development unless withdrawn. Removal of minerals is a loss of a nonrenewable resource but is in conformance to minerals law and Forest Service policy.	203,117 acres recommended wilderness. Little effect since there is no geologic environment for leasable resources	203,117 acres recommended. Potentially under 10 permits per year. Because these are personal use permits, there would be a continuing miniscule effect of pickup traffic (one truck per permit with a maximum of four trips each pickup) on existing forest roads. Removal of mineral materials is loss of a nonrenewable resource, but a service to the public in conformance to minerals law and Forest Service policy.

The biggest contrast to the no-action alternative are the recommended wilderness acres if they were to become designated wilderness. If designated, alternative C would have the least impact on the availability of minerals with 24,265 acres withdrawn for wilderness. Alternative B would recommend new wilderness at 55,779 acres. Alternative D would recommend the most acres for new wilderness at 203,117 acres. The recommended new wilderness areas in alternative D are larger than the already existing, total wilderness areas of 138,378 acres.

Cumulative Environmental Consequences

A discussion on cumulative effects of the alternatives presented in this document is intended to examine how the Cibola's actions and alternatives may be affected by management actions on adjacent lands or by outside forces. For locatable minerals, there is relatively little potential for policy or management in adjacent or other areas to affect the Cibola's management of minerals. Minerals management of locatable minerals is provided by an existing framework of law and regulations. It is nondiscretionary whether to allow locatable minerals operations on the Cibola, as long as the operations are in areas not withdrawn from mineral entry.

However, the economic demand for certain minerals can increase the number of minerals operations. The price of uranium or the demand for rare earth elements on the Cibola could result in more mineral operations and more on-the-ground impacts.

Leasable minerals activities, if they occurred, could be affected by changes in policy. The regional forester can consent or not consent to leasing requests received from the Bureau of Land Management.

Social and land use trends on public, State, tribal, and private lands across the Cibola would have the greatest impact on salable minerals. This is because Forest Service personnel have the discretion to offer sales, including where and what kind. Outside pressures that increase materials demand could influence the management of the Cibola National Forest to offer more sales. Also, sales on adjacent lands may influence a decision not to offer the same commodity from the national forest.

Under the alternatives B, C, and D, access to some mineral resources would be permanently withdrawn as wilderness, if wilderness were eventually designated. Overall, there could be a permanent loss of mineral resources that otherwise could contribute to local, national, and global markets for valuable commodities. The largest change in mineral resource consequences would occur with locatable minerals. For locatable minerals, all National Forest System lands reserved from the public domain (all of the plan area not withdrawn from the operation of the mining laws) are already open and available to exploration, development, and mining of the mineral resources therein. For leasable and salable minerals, Forest Service staff can make the minerals available or not, as desired.

Recreation

Affected Environment

Introduction

The Cibola's four mountain districts offer a variety of developed and dispersed recreational activities which include camping and picnicking, hiking, mountain biking, horseback riding, wildlife and scenic viewing, hunting and fishing, snow sports, and rock climbing. The four mountain districts are not contiguous and span 10 different counties.

The Cibola offers 17 developed campgrounds, 18 picnic areas, and over 700 miles of recreational trails. Approximately 243 miles of nonmotorized trails lie within wilderness, and about 200 miles of motorized trails across the forest. Recreation special use permits, such as special events, outfitting and guiding operations, and the Sandia Peak Ski Area, offer yet another aspect of available activities for visitors.

National visitor use monitoring survey data reports the most popular activities Cibola National Forest visitors participated in include hiking and walking, viewing natural features and wildlife, relaxing, and driving for pleasure. National visitor use monitoring data shows an increase in national forest visits on the Cibola from 1.3 million in 2006 to 1.4 million in 2011 (USDA Forest Service 2016). The most recent data from the 2016 survey shows yet another increase: nearly 1.6 million national forest visits.

Recreation Setting and Opportunities

Forest Service personnel utilize the recreation opportunity spectrum as a management tool to provide a spectrum of recreation opportunities that can be enjoyed in diverse settings. A recreation opportunity is the opportunity to participate in a specific recreation activity in a particular recreation setting.

Recreation opportunities include nonmotorized, motorized, developed, and dispersed recreation on land, water, and in the air. The social, managerial, and physical attributes of a place, when combined, provide a distinct set of recreation opportunities. Opportunities are provided along the spectrum from a very high probability of solitude, self-reliance, challenge, and risk (primitive) to very social opportunities where self-reliance, challenge, and risk are relatively unimportant (rural or urban). The physical setting is defined by the absence or presence of human sights and sounds, size, and the amount of environmental modification caused by human activity. The social setting reflects the amount and type of contact between individuals or groups. The recreation opportunity spectrum class characterizations are shown in table 35 below.

Table 35. Recreation opportunity spectrum class characterizations

Class	Characterization
Primitive (P)	Characterized by an essentially unmodified natural environment of fairly large size. Interaction between users is very low and evidence of other users is minimal. The area is managed to be essentially free of evidence of human-induced restrictions and controls. Motorized use within the area is not permitted. There are no developed facilities.
Semi-primitive nonmotorized (SPNM)	Characterized by a predominantly natural or natural-appearing environment of moderate to large size. Interaction among users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present but would be subtle. Motorized recreation is not permitted, but local roads used for other resource management activities may be present on a limited basis. Use of such roads is restricted to minimize impacts on recreation experience opportunities. A minimum of developed facilities (if any) are provided.
Semi-primitive motorized (SPM)	Characterized by a predominantly natural or natural-appearing environment of moderate to large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present but would be subtle. Motorized use of local primitive or collector roads with predominantly natural surfaces and trails suitable for motorbikes is permitted. Developed facilities are present but are more rustic in nature.
Roaded natural (RN)	Characterized by predominantly natural-appearing environments with moderate evidence of the sights and sounds of people. Such evidence usually harmonizes with the natural environment. Interaction among users may be moderate to high, with evidence of other users prevalent. Resource modification and utilization practices are evident but harmonize with the natural environment. Conventional motorized use is allowed and incorporated into construction standards and design of facilities, which are present and well defined.
Rural (R)	Characterized by a substantially developed environment and a background with natural appearing elements. Moderate to high social encounters and interaction between users is typical. Renewable resource modification and utilization practices are used to enhance specific recreation activities. Sights and sounds of humans are predominant on the site and roads and motorized use is extensive. Facilities are more highly developed for user comfort with ample parking.
Urban (U)	Characterized by a substantially urbanized environment, although the background may have natural-appearing elements. Renewable resource modification and utilization practices are to enhance specific recreation activities. Vegetation cover is often exotic and manicured. Sights and sounds of people on-site are predominant. Large numbers of users can be expected, both on site and in nearby areas. Facilities for highly intensified motor use and parking are available with forms of mass transit often available to carry people throughout the site

Recreation opportunity spectrum classes were assigned forestwide in the 1985 plan. Thus, it is possible the existing inventory from 1985 does not match the current use patterns on the Cibola over 34 years later. An important aspect of the recreation opportunity spectrum is to ensure the Cibola is providing a diversity of recreation settings and opportunities that respond to public desires and expectations.

Congressionally designated wilderness areas are often associated with a primitive type of recreation opportunity, but the primitive recreation opportunity spectrum class is not synonymous with designated wilderness. On the Cibola National Forest, the Sandia Mountain Wilderness, Manzano Mountain Wilderness, and Withington Wilderness are inventoried and mapped as the semi-primitive nonmotorized recreation opportunity spectrum class. Part of the Apache Kid Wilderness (8,965 acres) is classified as primitive, and the remainder is classified as semi-primitive nonmotorized. These wilderness area acres are included in the 1985 plan inventory shown in table 37 below.

Under the 1985 plan, the four designated wilderness areas were also inventoried and mapped using the wilderness opportunity spectrum. The wilderness opportunity spectrum provides a way to describe the variations in the degree of isolation from the sounds and influences of people, and the amount of recreation visitor use in designated wilderness areas. There are four wilderness opportunity spectrum classes: pristine, primitive, semi-primitive, and transition (table 36). Portions of the Cibola wilderness areas have been mapped for more than one wilderness opportunity spectrum setting.

Table 36. Wilderness opportunity spectrum for the Cibola National Forest (1985 plan)

Wilderness Opportunity Spectrum Setting	1985 plan (acres)
Pristine	10,013
Primitive	1,045
Semi-Primitive	110,933
Transition	15,248
Total	**137,239**

The assessment report identified a need to reinventory the recreation opportunities across the Cibola by recreation opportunity spectrum class, including wilderness areas, and make any necessary changes as needs for change are identified (USDA Forest Service 2015b). During the current land management plan revision effort, incorporating best available science and public input, a recreation opportunity spectrum existing condition inventory report was completed (USDA Forest Service 2015d). Table 37 displays the recreation opportunity spectrum classifications established under the 1985 plan compared to the updated inventory completed in 2015 for the mountain districts. The new inventory does not include wilderness opportunity classes.

Table 37. Recreation opportunity spectrum for the mountain districts [39]

Recreation Opportunity Spectrum Setting	1985 plan, (acres)	Percent of Cibola National Forest	2015 Updated Inventory	Percent of Cibola National Forest
Primitive*	8,965	0.60	49,661	3
Semi-primitive nonmotorized*	411,457	27	635,198	39
Semi-primitive motorized	777,736	52	704,254	44
Roaded natural	284,154	19	226,155	14
Rural	372	0.03	170	Less than 1
Wilderness opportunity spectrum*	137,239	N/A	N/A	N/A

* Wilderness opportunity spectrum overlaps with recreation opportunity spectrum within designated wilderness

[39] Both the 1985 plan and the 2015 updated inventory did not classify any National Forest System land in the urban setting.

Recreation Issues and Trends

The recreation program on the Cibola National Forest plays a key role in the social stability, environmental integrity, and economic vitality of the surrounding communities. A sustainable recreation program is integral in protecting the natural, cultural, and scenic environment for present and future generations to enjoy. Several factors relating to societal, lifestyle, and demographic trends can affect recreation participation.

Populations and demographics will change over time and new trends and demands will emerge from those changes. New Mexico's population has seen a 1.1 percent increase since 2010 (U.S. Census Bureau 2016b). New Mexico's population is projected to grow about 35 percent over the next 25 years (SCORP 2015). As population increases, visitor demographics of the population and national forest visitors will also become more diverse and will have changing expectations for recreation opportunities. As noted in the Cibola assessment, a study conducted by the Pew Research Center in 2013 showed a 28 percent increase in the Hispanic population in New Mexico from 2000 to 2011. These changing demographics will become increasingly more important in the management of recreation and scenic resources on the Cibola mountain districts.

The Cibola conducted a values, attitudes, and beliefs survey in 2005. Results discussed the combination of increased use from population growth and increased demand for limited recreational resources potentially resulting in the increased potential for one type of use to conflict with another (USDA Forest Service 2005).

Trail use continues to increase, resulting in ongoing challenges in the maintenance, construction, and reconstruction of trails. Additionally, unauthorized routes (created both by motorized and nonmotorized users) are on the rise, resulting in resource damage.

Off-highway vehicle use has increased in popularity on public lands throughout the country, including the Cibola National Forest. In 2005, the Chief of the Forest Service declared unmanaged recreation (and specifically unmanaged motor vehicle use) one of the four threats to the National Forest System. The 2005 Travel Management Rule provides regulations to help manage motor vehicle use on National Forest System lands. Implementation of the rule provides for a system of National Forest System roads, National Forest System trails, and areas on National Forest System lands designated for motor vehicle use. It prohibits motor vehicle use not in accordance with the designations. Travel management planning for the Cibola has been completed for all four mountain districts and implementation should reduce motorized travel off the designated system. All road and trail classifications can be found in the Cibola's motor vehicle use maps.

Mountain biking is another recreation use that has increased in popularity since the 1985 plan, notably on the Mt. Taylor and Sandia Ranger Districts, and will likely increase on all districts throughout the life of the plan.

Special use authorizations generate revenue for the Cibola each year. The growing demand for these services and or events may have greater implications on the general recreating public in the future.

Catastrophic wildfire and insects and disease outbreaks have negatively impacted recreational settings and scenic character in recent years. Events such as these are becoming the norm in the Southwest and result in a marked contrast to the naturally appearing landscape.

Environmental Consequences

The recreation opportunity spectrum provides a framework for defining the types of motorized and nonmotorized outdoor recreation opportunities the public might desire and identifies that portion of the spectrum a given national forest might be able to provide, sustain, or both. The recreation opportunity spectrum provides the structure for describing the Cibola's contribution to sustainable flows of recreation settings, and visitor opportunities. The recreation opportunity spectrum is used to describe whether management actions would sustain classes and related opportunities, change classes and related opportunities, or both.

Each proposed alternative below addresses the core themes and attempts to resolve significant recreation issues identified by the public.

Indicators

- Acres assigned to each recreation opportunity spectrum class. This indicator reflects changes to recreation settings due to anticipated management activities associated with each alternative. It reflects the relative balance between motorized and nonmotorized recreation settings that can be anticipated under each alternative.

Assumptions

- All alternatives provide for a variety of motorized and nonmotorized recreational settings and opportunities.
- The framework for recreation opportunity spectrum characteristics and sustainable recreation will be applied in project-level planning for all Cibola National Forest activities.
- Although the recreation resource managers can manage settings, they do so to provide opportunities for recreation experiences and the benefits those experiences produce for individuals and society. Those experiences are influenced by many factors, the settings, the activities, other resources present, activities by managers, and by the values, expectations and other characteristics of the recreationists (USDA Forest Service 1986a).
- Motorized vehicle use will continue to be designated and managed in accordance with the Travel Management Rule, 36 CFR parts 212, 251, 261 and 295.
- The Cibola National Forest contains an area on the Sandia Ranger District that is a Department of Defense withdrawal area. The public is not allowed within this withdrawal; therefore, it is not assigned a recreation opportunity spectrum class. The percentages reflected in the tables by alternative below will not include this 19,443.02 acres (1.20 percent).
- Visitor use information specific to each district is not available. National visitor use monitoring information is collected for the entire Cibola National Forest. Site-specific and recreation-opportunity-spectrum-related use data is not available.
- Land management plan amendments do not affect visitation rates on the Cibola; however, new or altered management direction may influence the type of opportunities that are available to the public.

Environmental Consequences Common to All Alternatives

All alternatives provide a framework for managing recreation through standards and guidelines in a land management plan. Similarities in this management direction across the alternatives include the following:

- Special use permits: All alternatives will allow for permitted authorizations for outfitting and guiding and recreational events upon completion of the proper environmental analysis. These guided activities have a possible positive effect on recreation visitors by providing opportunities to groups who may not otherwise be able to participate. Recreation events also have a potential positive effect to recreation by providing a variety of activities for visitors to participate in or spectate. Some potential effects to recreation from these types of authorizations may be crowding in certain areas, or competition for space.
- Wilderness: All alternatives will continue to offer designated wilderness. Wilderness offers many potential benefits to recreation, one being the simple experience of solitude in nature. Potential effects associated with designated wilderness are differing type of management prescriptions on these acres of land as well as exclusion of motorized travel in these areas which may impact certain users.
- Recreation opportunity spectrum: All alternatives will continue to manage the forest using the recreation opportunity spectrum system. This has a potential positive effect on recreation by allowing for a variety of uses across the forest. A potential effect to recreation from the recreation opportunity spectrum system is that within each classification, use types are specific, limited, or both therefore causing possible impacts to those users who may want to do a certain activity in an area that does not allow it based on the recreation opportunity spectrum classification. For example, semi-primitive nonmotorized does not allow for motorized access. An overlay of the desired recreation opportunity spectrum classes is in appendix D. Table 42 displays the acres of desired recreation opportunity spectrum under each plan alternative.
- Recreation activities: All alternatives still allow for all recreation use types. Some alternatives may specify certain areas which are designated for particular use types, but each alternative offers a wide variety of recreational experiences. This is a potential positive effect to recreation by allowing for multiple uses across the forest.

Environmental Consequences – Alternative A

Under alternative A, the no-action alternative, the 1985 plan would remain in effect. Cibola National Forest personnel would continue to use the recreation opportunity spectrum and wilderness opportunity spectrum outlined in the existing condition from 1985 and as defined in table 38, and current management practices would continue as they are outlined in the 1985 plan.

Table 38. 1985 plan recreation opportunity spectrum and wilderness opportunity spectrum acres by class

Recreation Opportunity Spectrum Setting	1985 plan (acres)	Percent of Cibola National Forest
Primitive*	8,965	0.60
Semi-primitive nonmotorized*	411,457	27
Semi-primitive motorized	777,736	52
Roaded natural	284,154	19
Rural	372	0.03

* Wilderness opportunity spectrum overlaps with recreation opportunity spectrum within designated wilderness.

Nearly half of the Cibola National Forest would remain in the semi-primitive motorized class and approximately 27 percent would remain in the semi-primitive nonmotorized. The primitive class and wilderness designation is not synonymous; therefore, the wilderness opportunity spectrum would continue to provide management direction for the designated wilderness areas across the Cibola and other settings would follow class specifications outlined in the plan. There are both potential positive and negative effects to recreation by the recreation opportunity spectrum classifications set forth in alternative A. A potential positive effect would be that these settings would continue to provide opportunities for visitors to see and enjoy the Cibola National Forest in a variety of different experiences. A potential adverse effect from the recreation opportunity spectrum classifications outlined in the 1985 plan is that they do not reflect the current use of the Cibola. Over the years, use has changed, desired recreation opportunity spectrum has changed, and the acres do not reflect the reality of what is on the ground.

All current management areas and designated areas would continue to exist as they are described in the 1985 plan. All 18 areas would continue to provide different user opportunities through distinct management emphasis.

It may be challenging to recreation managers to provide a sustainable recreation program now and into the future by referencing a document created in the mid-80s. Recreation trend data and visitor use has changed dramatically over time and the issues, opportunities and expectations are vastly different. A potential adverse effect to recreation would be a loss of trending opportunities to the public. There would also be potential adverse effects to future recreation opportunities because they would not be provided for in management direction and therefore may not be allowed.

Recreation management will continue to provide dispersed and developed recreation opportunities and enhance experiences by providing access, services, and facilities with other resource considerations. There will continue to be an emphasis on dispersed recreation in alternative A and less of an emphasis on developed recreation. For recreationists this would be a potential effect due to the trending recreational vehicles (RVs) and car-camping opportunities that are becoming widely popular. Developed recreation would need to keep up with trends to not cause a potential impact to these recreation users.

With parts of each designated wilderness being in a different wilderness opportunity class and not using the same method for classification (recreation opportunity spectrum) as the rest of the Cibola, the 1985 plan may be more difficult to comprehend to the recreating public. The wilderness opportunity spectrum framework is not a widely used classification process and would be a potential effect to users who are used to the standardly-used recreation opportunity spectrum classifications. Portions of the Cibola wildernesses have been mapped for more than one wilderness opportunity spectrum settings. The management direction varies depending on the setting; however, because the wilderness opportunity spectrum settings are not delineated on the ground, it is not clear to the public what setting they are in. This leads to confusion among recreation users and how they can enjoy their wilderness areas across the forest. It also leads to potential compliance and management issues for land managers. Continuing to use this outdated and confusing classification system would be a potential impact on recreation.

For all other recreation-specific management standards and guidelines, reference the 1985 plan (USDA Forest Service 1985a). For a more in-depth discussion on wilderness and other designated areas, please reference the “Designated Areas” section of this environmental impact statement.

Environmental Consequences Common to Action Alternatives B, C, and D

Alternatives B, C, and D would include and potentially adopt desired recreation opportunity spectrum classes for the Cibola National Forest and the guidance for project-specific analysis and implementation would be referenced by the recreation opportunity spectrum guidebook and in plan components. Decisions related to recreation settings and related physical and social components would be consistent with the adopted desired recreation opportunity spectrum classes.

Under alternatives B, C, and D, the revised plan would contain components in the form of desired conditions, objectives, standards, and guidelines to better address or align with the framework for sustainable recreation. These components would also help Cibola personnel in moving toward the management of a sustainable recreation program and allow a better response to current recreation activities and adapt to current and future demands for recreation.

Developed Recreation

Developed recreation on the Cibola includes the management of several campgrounds, picnic areas, trailheads, ski-areas and other day-use sites across all four mountain districts. All action alternatives propose a desired condition for recreation that aligns with sustainable recreation practices and provides for a range of high quality recreation settings which allow for collaboration and community involvement as well as education and interpretation programs.

Management guidance for sustainable developed recreation in each alternative is identified with standards and guidelines outlined in the draft plan, for example;

- Constructed features should be maintained to support the function(s) for which they were built. When no longer used as intended, they should be repurposed to accommodate the new use or decommissioned to minimize maintenance backlog and infrastructure deterioration, and to protect public safety and health (draft land management plan, FW-GDL-DREC-4).

Removing, improving, or restoring developed recreation facilities may have potential impacts on recreationists. The removal of sites would lower the amount of recreation facilities available to the public but could have lasting effects of moving the Cibola toward a sustainable and resilient recreation program by lowering the amount of deferred maintenance thus lowering the cost to staff and maintain old facilities. The short-term impacts may be the displacement of users or the relocation of recreation activities due to closing or removing old sites.

Improving or restoring recreation facilities would have potential short-term effects but overall potentially beneficial long-term effects. In the short term, recreationists may be displaced due to the temporary closure of a site they planned to visit or partial closures for site repairs or maintenance. The long-term effect would be improved recreation opportunities leading to a more positive recreation experience.

Dispersed Recreation

Dispersed recreation on the Cibola includes management of a variety of motorized and nonmotorized recreation opportunities, for example, motorized and nonmotorized trail use, hiking, dispersed camping, wildlife viewing, hunting, fishing, and photography.

Management guidance for sustainable dispersed recreation in each action alternative is identified in desired conditions, standards and guidelines outlined in the plan, for example:

- The systems of motorized and nonmotorized trails provide a variety of opportunities and settings for visitors to explore the national forest. The trail system is sustainable and enhances the recreation opportunity, while minimizing user conflict and damage to Cibola's natural and cultural resources (draft land management plan, FW-DC-DISP-2).

As outlined in the draft plan, a dispersed recreation objective for each action alternative proposes to evaluate up to 10 percent of forestwide trail system mileage for need, condition, use, relevance, and sustainability, and take action as appropriate over the life of the plan.

Management activities related to forest health across the Cibola would continue to be the same with alternatives B, C, and D. Prescribed or naturally ignited fires would pose a short-term potential impact to the recreation resource due to displacement of recreationalists and impacts from smoke in the air such as health, visual quality of their experience, or both. Mechanical treatments would also pose a negative effect to recreation in all alternatives due to the short-term closure of areas being treated and potential displacement of users. However, in alternative D these impacts would be much less due to the emphasis on natural processes and naturally ignited wildfires. There would be a short-term potential impact to the visual quality of an area that has been treated, which in turn is a potential impact on the recreation resource. Long-term impacts to the recreation resource from various treatment types would be improved quality of landscapes across the Cibola.

Mountain biking would be impacted due to the forestwide standard (FW-STD-RECW-2) prohibiting mechanized equipment in recommended wilderness areas across each alternative. Mountain bikers would be displaced from areas they once used to recreate in due to adding recommended wilderness acres.

Climate change may negatively impact recreation opportunities in the future. Maintaining ecosystem resistance and resiliency may help mitigate potential impacts of climate change to the recreation opportunities on the Cibola. These effects may include increased visitation across multiple recreation sites due to longer shoulder seasons; no snow fall in November and December means more opportunities to recreate during the extended season. This could mean a greater need for recreation management and facility care in these locations. The same is true for winter recreation; less snowfall year after year means less winter recreation opportunities available across the Cibola, which would negatively impacts those users.

On the other hand, climate change may also impact recreation in the opposite way. Severe fire or other implications due to a hotter, drier summer climate may close recreation facilities for an extended period of time, thus limiting the recreation experiences available in that area. Some other effects may be an increase in the availability of limited resources such as water. Water is a popular and sought-after recreational component. If there is less available, there may be more conflicts and competition for resources among recreationists. With the anticipated increase in public use across the forest, this could make it more difficult to manage impacts to these limited resources. Alternatives B, C, and D all address potential impacts of climate change, by incorporating sustainable recreation opportunities which are adaptable to changing uses and trends over time. The recreation program will focus on adaptive management techniques such as adopting design standards and best management practices for emerging recreation activities, use of sustainable operations at developed recreation sites and accommodating sustainable use levels with the trail system.

Environmental Consequences – Alternative B

Alternative B is aimed at addressing all of the core themes; respecting cultural and traditional landscapes and uses, valuing unique places and features, managing holistically for watershed and ecosystem health, and managing for sustainable recreation. In addition to forestwide recreation plan components, there are stand-alone plan components for the thirteen proposed management areas under this alternative.

This alternative would create a change in recreation opportunity spectrum settings. Alternative B recommends 55,779 acres for wilderness designation that contain wilderness characteristics. This action also classifies all designated and recommended wilderness into the primitive recreation opportunity spectrum class. It gets rid of the wilderness opportunity spectrum system used in the 1985 plan, similar to the 2015 inventory of the recreation opportunity spectrum and creates a more consistent approach to the management of wilderness areas across the Cibola, which is a potential effect on the recreation resource. This action subsequently decreases the other recreation opportunity spectrum classes, such as the semi-primitive motorized and roaded natural classes which can be an effect to recreation. This would cause an impact to recreation users who might be used to doing a specific activity in an area that was once semi-primitive motorized or rural opportunity class, and it is now primitive where activities are restricted to nonmotorized use. A potential converse effect would mean more primitive areas for those type of users seeking solitude and primitive recreation opportunities to explore.

Under alternative B, management of recreation would be guided by the adopted recreation opportunity spectrum classes for all the mountain districts across the Cibola National Forest.

Table 39. Recreation opportunity spectrum setting by acres for alternative B compared to alternative A

Recreation Opportunity Spectrum Setting	Alternative A	Alternative B	Percent of Cibola National Forest
Primitive*	8,965	155,686	9.63
Semi-primitive nonmotorized*	411,457	521,967	32.31
Semi-primitive motorized	777,736	714,779	44.24
Roaded natural	284,154	202,945	12.56
Rural	372	869	0.05

* Wilderness opportunity spectrum overlaps with recreation opportunity spectrum within designated wilderness for alternative A.

With the identification of desired recreation opportunity spectrum settings in alternative B, Cibola National Forest personnel would be providing a balanced range of recreation opportunities within limits of their administrative and resource capacity. While this alternative adds more opportunities for solitude and unconfined recreation, it also increases the opportunities for a more rural and semi-primitive nonmotorized experience.

Other proposed management actions such as mechanical treatments and prescribed burning may temporarily displace recreationists and impact recreation opportunities in the short term by temporary closures for project boundaries within recreation sites, smoke or air quality impacts or unsightly treatments and equipment noises. In the long run, these treatments would enhance the recreation environment by reducing the risk of uncharacteristic wildland fire and improving scenery, habitat, and watershed function.

Environmental Consequences – Alternative C

Alternative C was developed to emphasize restoration and partnerships through various methods of restoration treatments. In addition to the forestwide recreation plan components mentioned in the consequences to all action alternatives, there are stand-alone plan components for the purpose-based conservation and restoration management areas that relate to recreation.

Restoration management areas have several benefits to improve the overall health and sustainability of the forest. One purpose of the restoration management areas is to improve overall watershed health and protect and sustain highly valued cultural sites and wildland urban interface zones. Restoration methods would be focused on managed fire use, road removal or relocation, and mechanical thinning to reduce fire hazard and protect infrastructure. Fuelwood collection would be widely available in these areas. These management areas have a high density of developed recreation sites such as campgrounds, trailheads, and day-use areas. Recreation management guidelines and management approaches for these areas include some of the following (draft land management plan, chapter 3, management areas and designated areas, restoration management area):

- Temporary roads may be constructed where appropriate and in balance with other resources to facilitate the removal of wood products, and mitigations should be taken to meet other resource desired conditions once roads are no longer needed after projects are complete (MA-GDL-REST-1).
- The ability to access areas for vegetation treatments and removal of wood products should help determine the nature and frequency of road maintenance (MA-GDL-REST-2).
- Management within the area should provide a balance of vegetation treatment opportunities and recreation opportunities (MA-GDL-REST-3).
- Support local industry's efforts to utilize wood products from restoration treatments to sustain wood processing facilities and jobs (MA-MGAP-REST-4)

Conservation management areas emphasize unique opportunities for protecting and enhancing values such as solitude, scenic integrity and socioeconomic opportunities that emphasize backcountry and primitive recreation. The focus of conservation areas would be on primitive recreation; motorized access in conservation areas would be limited. Limiting motorized access would impact recreationists who participate in that type of recreation, they may be displaced or may have to find other places for their activities. This would be a potential positive impact to recreationists who seek a more quiet and primitive experience on the Cibola. Developed recreation opportunities would remain the same in these management areas, and more prescribed and managed fire would occur than thinning except within road corridor buffers adjacent to roads designated in approved travel management plans. These areas would not be classified as suitable timber. For recreational users who enjoy a more dispersed experience, decreasing the amount of recreational development across the Cibola would be a potential positive impact to those users. The desired condition for conservation management areas would be to provide for and emphasize primitive, unconfined, and backcountry types of recreation and provide opportunities for solitude. Motorized access would remain at current levels or decrease over the life of the plan to protect high-value natural and tribal cultural resources within the area, as well as to maintain the emphasis on backcountry and primitive recreation opportunities.

This alternative would create a change in recreation opportunity spectrum settings. Alternative C recommends to add an additional 24,265 acres of recommended wilderness.

Table 40. Recreation opportunity spectrum setting by acre for alternative C compared to alternative A

Recreation Opportunity Spectrum Setting	Alternative A	Alternative C	Percent of Cibola National Forest
Primitive*	8,965	124,183	7.6
Semi-primitive nonmotorized*	411,457	549,064	35.19
Semi-primitive motorized	777,736	719,133	44.51
Roaded natural	284,154	203,069	12.57
Rural	372	869	0.05

* Wilderness opportunity spectrum overlaps with recreation opportunity spectrum within designated wilderness in alternative A.

Developed Recreation

Management direction for sustainable developed recreation in alternative C is identified in standards and guidelines outlined in the plan and impacts from these can be found in the effects common to all alternatives section above. Alternative C provides an emphasis on expanding the scope of existing restoration but also a focus on high priority areas, developed recreation near roads, entry points, and forest boundaries. Within the conservation management areas, there would be limited future development for developed recreation and more emphasis on the primitive setting.

With a higher emphasis on primitive recreation in this alternative, impacts to developed recreation may occur. Users who prefer a developed experience with multiple campground amenities will need to look elsewhere for these opportunities, as they would not be as prevalent in this alternative.

Dispersed Recreation

The desired recreation opportunity spectrum settings in alternative C would be providing a similar balance and range of recreation opportunities as in the current condition, with an added emphasis on conservation and restoration. Alternative C still provides a notable increase in the primitive recreation setting, providing the opportunity for solitude and dispersed recreation due to the amount of recommended wilderness acres.

Alternative C proposes to allow more fuelwood cutting permits available to the public. This would have temporary impacts to dispersed recreationists as they may see sights and sounds of chainsaws or other wood cutting activities, but potential positive long-term effects by improving scenery (if proper mitigations are followed at the project level) and forest health.

A dispersed recreation objective for alternative C proposes to evaluate up to 10 percent of the forestwide trail system mileage for need, condition, use, relevance, and sustainability over the life of the plan. By evaluating these existing trails, impacts could include displacement of users if trails are removed or repaired and temporarily closed. This would be an overall positive impact to recreation in that it will improve the opportunities on the Cibola as well as improve conditions of various trails.

The management actions associated with this alternative would have the same impacts to recreationists as alternative B, although they would be at a slightly higher magnitude based on the increase in annual restoration projects. Long term, this would enhance the recreation environment and improve scenery, habitat, and watershed function throughout the Cibola National Forest. Other impacts to recreation would be the potential future loss of facilities or future motorized access in some areas as they would be managed as nonmotorized. Existing developed recreation in the conservation areas would not vary drastically from current levels and future motorized access would potentially decrease.

Environmental Consequences – Alternative D

Alternative D emphasizes backcountry and primitive recreation by decreasing the intensity of restoration treatments using mechanical means and allowing a more natural approach, as with managing naturally-occurring fires. The intent of this alternative is to provide more solitude, remoteness, and primitive recreation, with more emphasis on dispersed recreation than developed recreation. Alternative D includes the most areas of recommended wilderness of all alternatives including many areas the public identified for consideration. Adding recommended wilderness across the Cibola National Forest would create a more primitive recreation opportunity for visitors, such as nonmotorized trails and minimizing future development of developed recreation sites. Primitive means of recreation such as hiking, horseback riding, and hunting are emphasized in this alternative and motorized access for recreation is limited and potentially not expanded under this alternative.

Alternative D would create the greatest change in desired recreation opportunity spectrum settings by recommending the most acreage of wilderness and the primitive recreation opportunity spectrum class (Mt. Taylor District: 27,348, Magdalena: 166,025, Mountainair: 9,463, and Sandia: 281, in total 203,117 acres). The primitive recreation opportunity spectrum class would move close to 20 percent of the Cibola. Associated impacts to recreation would be a decrease of motorized opportunities available for users who desire that experience, who would then need to find new places to recreate. With less motorized opportunities available across the Cibola, this means an increase in primitive and unconfined recreation. This would be a potentially positive impact to users who desire a wilderness or primitive experience. The desired semi-primitive motorized recreation opportunity spectrum class would see a slight decrease.

Table 41. Recreation opportunity spectrum setting by acre for alternative D compared to alternative A

Recreation Opportunity Spectrum Setting	Alternative A	Alternative D	Percent of Cibola National Forest
Primitive*	8,965	302,981	18.75
Semi-primitive nonmotorized*	411,457	406,432	25.15
Semi-Primitive Motorized	777,736	689,860	42.70
Roaded Natural	284,154	196,131	12.14
Rural	372	869	0.05

* Wilderness opportunity spectrum overlaps with recreation opportunity spectrum within designated wilderness in alternative A.

Developed Recreation

Since recreation in alternative D is more focused on recommended wilderness and conservation areas on a mid-scale, there is an intent in the alternative to minimize additional developed recreation in the future. Primitive means of recreation, such as hiking, horseback riding, and hunting, are emphasized, and motorized access for recreation is limited and potentially not expanded under this alternative. Minimizing the amount of future developed recreation across the forest would mean that new trends in recreation may not be accommodated, thus meaning a possible impact to future recreation opportunities. If a more developed type of experience was desired in the future by Cibola visitors, this alternative would leave little room for growth and the ability to accommodate these uses in the future and force visitors to find that opportunity elsewhere.

Dispersed Recreation

Effects of this change to a more primitive setting would be potentially positive for those visitors seeking a more remote experience and would potentially impact those visitors who prefer a more developed and motorized experience. The areas proposed as recommended wilderness contain the characteristics needed to fall into such class. New standards and guidelines would be implemented to protect these areas for their wilderness character. For example, no new permanent or temporary roads, motorized trails, or mechanized (for example, mountain bike, e-bike) trails for public access shall be constructed in or designated in recommended wilderness management areas (FW-STD-RECW 2). Visitors seeking a motorized recreation experience would be potentially impacted with this alternative by reducing the acreage of available land for motorized and mechanized recreation.

Cumulative Environmental Consequences

A discussion on cumulative effects of the alternatives presented in this document examines how social and land use trends on public, State, tribal, and private lands across the mountain districts together influence the management of the Cibola National Forest. These public lands provide a wide range of recreation opportunities in addition to the Cibola, however, some major differences in agency missions and goals exist and may often result in different types of recreation experiences at each of those locations.

Management actions on these adjacent lands may provide some of the same benefits that the actions proposed in these four alternatives would provide. Most state and local land managers conduct similar assessments to determine the impacts to all resources involved in project planning. The New Mexico Statewide Comprehensive Outdoor Recreation Plan (SCORP 2016) discusses goals of managing recreation through commitment to stewardship and the preservation of natural beauty and conservation of resources. Several lead organizations have outlined objectives for obtaining this goal across the state. If Federal, State, and local land managers work together in promoting and managing recreation across the state, the land within, and adjacent to, the Cibola National Forest will not be negatively impacted at a compounded rate. If land managers do not address current issues or set goals for achieving a sustainable recreation program, users may not find the positive experience they seek from recreation opportunities. This could mean displaced recreational users, decreased opportunities, and overall decrease in satisfaction with their national forest experience.

Within the planning period (the next 10 to 15 years), human population growth—as well as growth and demand for a variety of recreation settings and opportunities—is expected to increase. A growing human population places increasing demands on recreation that could result in more human concentration and use at existing recreation areas, increased conflicts, increased density in motor vehicle use, and reduced quality of recreation settings. An increase in population may also provide more opportunities for partnerships and outreach for stewardship projects. This would be a potentially positive impact to recreation as a whole by adding man power on the ground and providing sustainable recreation projects to the Cibola.

The increased use of off-highway vehicles may result in increased conflict among motorized and nonmotorized user groups throughout the cumulative effects analysis area. As use increases, compliance with regulations could become a greater challenge as recreational participants increase and often compete for limited or popular space and resources. The primitive and semi-primitive nonmotorized settings can be more vulnerable to increased visitation and use conflicts.

Climate variations over time have led to a larger shoulder season in many areas of the country. Environmental changes may negatively impact recreational opportunities due to hotter summers and shorter winters. This can create a busier shoulder season and potentially new and emerging recreational activities appearing in new locations and at unusual times of the year. With hotter and dryer summers, there is an increase for potentially devastating wildland fires. This could mean fire closure orders at multiple recreation sites, wilderness areas, trails, and other day-use facilities across the Cibola, which would then potentially negatively impact Cibola National Forest visitors because access to the national forest would be closed, and recreation opportunities would not be available.

The steady increase of hot and dry summers adds strain on already limited resources such as water. The demand for these valuable resources will continue to increase and protection measures will be extremely important now and into the future. Managers need to be cognizant of the changing weather patterns and the effects that may occur on future recreation trends and resources, such a competition for water, conflicts among users and decreased availability of water recreation across the Cibola

The last 5 years have shown a decrease in the overall recreation program budget, and it is likely that trend will continue into the future. Support for recreation staff, law enforcement, and facilities could see a decrease in some areas, while higher-use areas may need to be prioritized. The backlog of deferred maintenance may stay the same or increase over the years due to declining budgets. This would have a potential adverse effect on visitors and recreation mangers of the Cibola National Forest. It could cause users to look elsewhere for their experiences, or they could have a poor experience based on limited resources available for operations and maintenance and capital investments in recreation opportunities. Land management agencies will continue to provide a variety of recreation opportunities throughout the region; however, they may not be able to meet the demand for every activity desired. Focusing on a sustainable recreation program which can accommodate the decreased budgets would be the best option for a successful recreation program on the Cibola.

Effects may occur regardless of the alternative selected. User controls may be needed in areas that become overcrowded to protect the health of the natural ecosystems and maintain an acceptable recreation setting for the public.

Recreation Summary

With the exception of alternative A, the no-action alternative, the desired recreation opportunity spectrum settings would change in alternatives B, C, and D. Alternative B recommends 55,533 additional acres of wilderness. Alternative C is the restoration-based alternative where the concentration of management is on restoration and conservation of specific management areas. Alternative C recommends 24,019 acres of wilderness to be added to the primitive recreation opportunity spectrum setting. Alternative D proposes a less intensive approach to management and adds 203,117 acres of recommended wilderness with a desired primitive recreation opportunity spectrum class. With this action, there would be more primitive recreation opportunity spectrum settings available to recreation visitors and a concentration on the dispersed recreation setting as opposed to the developed. As a result, across all, opportunities for primitive, unconfined recreation consistent with recommended wilderness designation would increase with alternative C, and more considerably with alternative B, and most in alternative D.

Table 42. Comparison of recreation resource indicators by alternative

Indicator	Alternative A	Alternative B	Alternative C	Alternative D
Change in the recreation opportunity spectrum	No change	55,533 acres of proposed recommended wilderness	24,019 acres of proposed recommended wilderness	203,117 acres of proposed recommended wilderness
Primitive settings	8,965*	155,686	124,183	302,981
Semi-primitive nonmotorized settings	411,457*	521,967	549,064	406,432
Semi-primitive motorized	777,736	714,779	719,133	689,860
Roaded natural settings	284,154	202,945	203,084	196,131
Rural settings	372	869	869	869

* Wilderness opportunity spectrum overlaps with recreation opportunity spectrum within designated wilderness in alternative A.

Motorized and nonmotorized recreation opportunities would neither increase nor decrease under any of the alternatives as a result of the recommended wilderness areas as these areas have consistently been managed for nonmotorized uses due to their proximity to current designated wilderness areas. One notable change due to the additions of desired primitive recreation opportunity spectrum would be mountain biking could no longer occur in these recommended wilderness areas.

Under all alternatives, integration, collaboration, and active engagement with communities are essential components of creating long-term sustainable recreation programs. The importance of community stewardship and partnerships would grow increasingly important over the life of the plan, requiring agencies at all levels to share resources and increase collaborative efforts regarding sustainable resource management. Funding across all local, State, and Federal governments is limited for construction and renovation of facilities, operations and maintenance, planning and monitoring, and staffing programs. These budget issues are presenting challenges to all land managers as they attempt to continue providing recreation for a growing and changing population. Securing adequate funding to maintain, construct, or reconstruct recreation facilities and trails to meet the needs of a growing population will be a challenge under all alternatives.

Recreation opportunity is "the availability of a real choice for a user to participate in a preferred activity within a preferred setting, to realize those satisfying experiences which are desired" (USDA Forest Service 1986). Having a diverse setting of opportunities available for visitors to the Cibola National Forest is a goal continued throughout each alternative. Cibola National Forest personnel will work to create opportunities that are resilient and relevant for current and future generations; foster social and economic opportunities; and sustain the health, diversity, and productivity of the land to provide for a sustainable future.

Scenic Resources

Scenic resources on national forests are important because they affect how people experience the landscape; scenery includes the ecological features and human elements of the national forest, which combine to give an area identity and contribute to a sense of place. People value scenery with natural appearing landscapes. Scenery varies depending on existing natural features including vegetation, water features, landform and geology, cultural features, and human alterations (for example, buildings, structures, manipulations of the land or vegetation).

Scenery was identified in the need for change statements in the assessment executive summary (USDA Forest Service 2015a). There is a need for the revised plan to incorporate the scenery management system for managing scenic resources across all program areas. This statement recognizes that scenery is directly and indirectly related to multiple need for change topics. Restoration of vegetation structure and improvement of forest health improves scenery, especially in the long term. Restoration, conservation, and maintenance of grasslands, meadows, riparian ecosystems, and soils also improves scenery. Water features increase the scenic attractiveness of the national forest and measures to improve water resources also improve and enhance scenery. Additionally, scenic character is a component of managing for sustainable recreation. Areas of tribal importance, natural and cultural resources, and high places (mountaintops and ridges) also relate to scenic resources.

Affected Environment

General Description of Scenic Resources on the Cibola National Forest

The landscapes of the Cibola National Forest have a variety of features providing spectacular scenery in the Southwest. There are nine sky island mountain ranges with varying landforms and vegetation types: Mt. Taylor, Zuni, Datil, Magdalena, Bear, San Mateo, Manzano, Gallinas, and Sandia Mountains. These mountain ranges are spread across four ranger districts: Mount Taylor, Magdalena, Mountainair, and Sandia. The Cibola National Forest is valued for its recreation opportunities, natural beauty, forest products, watersheds, water, forage, and wilderness resources (USDA Forest Service 2015b). The Cibola National Forest has a variety of scenic settings ranging from high mountain peaks formed by volcanic calderas to craggy steep cliffs of the Sawtooth Mountains to mesas, canyons, deserts, meadows, and grasslands. The Manzano Mountains are known for remarkable fall colors. The Sandia Crest, a sheer rock face along the ridge of the Sandia Mountain Range, is a prominent scenic feature and backdrop to views of Albuquerque. People are drawn to the Cibola National Forest for its stunning views, diversity of scenic landscape features, and range of recreation opportunities from developed sites to remote designated wilderness. A detailed description of scenic character attributes of each district can be found in the Cibola National Forest scenic character descriptions (USDA Forest Service 2015b).

Existing Conditions and Trends

Managing for scenic integrity benefits the local and regional economy of the Cibola National Forest area. The Cibola is a popular recreation area for local communities, the state of New Mexico, and surrounding states. The scenic character of the Cibola National Forest contributes to the quality of recreation opportunities and the general quality of life for residents and local stakeholders. Both residents and visitors experience a particular sense of place that is dependent on the natural environments and cultural landscapes of the Cibola.

Viewing natural scenery, sightseeing, driving for pleasure, and photographing natural features are among the Nation's highest ranking recreational activities (Cordell 2008). Additionally, viewing, taking photos, or otherwise observing and appreciating nature has been the fastest-growing type of nature-based recreation (Cordell 2012). A variety of developed and dispersed recreational activities take place across the mountain districts. Trends to spend more time on the Cibola and enjoy the natural scenic beauty of the forest environment exist since viewing natural features or scenery has been among the top two recreation activities on the Cibola during the last three rounds of national visitor use monitoring (USDA Forest Service 2012b, 2012c, and 2016). Viewing natural features was the most popular activity on the Cibola National Forest, hiking or walking the second most popular activity, driving for pleasure the sixth most popular activity, and over 20 percent of national forest visitors reported using a scenic byway (USDA Forest Service 2016). The national visitor use monitoring described above, along with national trends, indicate a steady to increasing demand and use are anticipated for viewing natural features or scenery and driving for pleasure. It is important to manage the scenic resources to ensure a quality sightseeing experience for the public. Scenery is an integral component of all forest settings, and contributes to the quality of the users' experience. Providing a natural appearing landscape for these visitors is important since Cibola National Forest visitors rank scenery and attractiveness of the forest landscape as important to very important (USDA Forest Service 2012b, 2012c, and 2016).

Scenery is a key component of the designated areas of the Cibola National Forest. Designated wilderness areas provide distinctive scenic features and unaltered, naturally evolving scenic character. Inventoried roadless areas have a naturally appearing scenic character. Scenic byways and the Continental Divide National Scenic Trail provide sought-after scenic viewing experiences for northern New Mexico. A list of the scenic byways passing though and near the Cibola National Forest and other designated areas within the Cibola can be found in the volume 2 of the assessment (USDA Forest Service 2015b). Scenery is an important attribute outside of designated areas as well. The Fourth of July Canyon Campground receives heavy use during the fall color season as users flock to view the vibrant colors and spectacular display of the bigtooth maple trees.

Management of multiple resources has, to varying degrees, altered the natural scenic character. The most obvious effects on scenic resources are from vegetation and landform alterations. Resource management activities that have altered scenic resources include, but are not limited to, vegetation management, mineral extraction, roads and trails, campgrounds and picnic grounds, fire management (suppression and prescribed fire), and livestock grazing. The assessment also discusses the potential for wind energy and uranium mining (USDA Forest Service 2015b).

Most noticeable changes to scenic conditions across the landscape occur through natural processes such as wildfires, flooding, or insect and disease outbreaks. These natural disturbances have shaped, and will continue to shape, the vegetation and landform features of the landscape, affecting the overall sustainability of the scenic character. Although fire can dramatically alter scenery, fire can also benefit scenic character, depending on the level of burn severity. Wildfires which burn with mixed severity have fewer impacts to scenic character than those that burn with high severity and cause greater tree mortality. Low- and mixed-severity fires are often part of the characteristic landscape. Fires which burn with high severity can greatly change the vegetation and dominate views of the landscape in these areas. Mortality from insect and disease outbreaks has altered the scenic quality on the Sandia and Mt. Taylor Ranger Districts. Other factors which will continue to affect the sustainability of the scenic character of the Cibola are drought conditions affecting vegetation and water features and invasive species affecting native vegetation. For more conditions and trends affecting scenic character, see volume 2 of the assessment (USDA Forest Service 2015b).

Existing Conditions Shown through Components of the Scenery Management System Inventory Process

The Scenery Management System provides a systematic approach for determining the relative value and importance of scenery in National Forest System lands. Ecosystems provide the environmental context for the scenery management system. In 2013 and 2014, Cibola National Forest personnel completed the Scenery Management System inventories as part of the plan revision process to map existing condition of the scenic resources. Scenery Management System inventories are described in detail in the Scenery Management System inventory report for the Cibola National Forest (USDA Forest Service 2015e). The scenery management system inventory included mapping of:

- existing scenic integrity (the existing condition of scenic resources);
- scenic attractiveness (the intrinsic scenic beauty of a landscape based on land form, rock form, water form, and vegetation);
- concern levels (the relative concern for scenery along roads and trails);
- visibility (the foreground, middle ground, and background areas visible from concern level roads and trails);
- scenic classes (the relative importance of scenery); and
- scenic character descriptions (existing condition descriptions of valued scenic attributes and scenic character written at the ecological subsection scale). The scenic character description is stand-alone document (USDA Forest Service 2015e).

The following tables provide a summary in acres and percent of forest for each of the above inventories.

Table 43. Existing scenic integrity level acres (USDA Forest Service 2015)

Existing Scenic Integrity Level	Acres	Percent of Forest	Cibola National Forest Landscape Examples
Very high (unaltered)	214,634	13	Designated wilderness areas, some inventoried roadless areas
High (appears unaltered)	712,331	44	Areas of the Cibola where roads and trails are the main human activities, including some inventoried roadless areas, research natural areas, and areas like the Sawtooth Mountains. Other activities may be present such as prescribed burning, livestock grazing structures, or other low impact facilities
Moderate (slightly altered)	675,708	42	General areas with recreation developments, more developed travel corridors, administrative sites, vegetation management, fuels reduction activities, Sandia Peak Ski Area, and some smaller utility line corridors where vegetation clearing is not noticeable
Low (moderately altered)	8,235	1	More intensive vegetation management, oil and gas activities, some reclaimed mining activities, the tramway terminal at the Sandia Peak Ski Area, and Langmuir Research Laboratory facilities
Very low (heavily altered)	4,532	< 1	Vegetation management with unnatural appearing edges or geometric shapes, communication sites, major utility corridors, gravel pits, and other surface mining activities
Unacceptably low (extremely altered)	0	0	None

Note: The acres calculations only include National Forest System lands.

Table 44. Scenic attractiveness class acres (USDA Forest Service 2015)

Scenic Attractiveness Class	Acres	Percent of Forest
A – Distinctive	440,146	27
B – Typical	1,033,559	64
C – Indistinctive	141,715	9

Note: The acres calculations only include National Forest System lands.

Table 45. Visibility, distance zones, and concern level acres (USDA Forest Service 2015)

Distance Zones/Concern Level	Acres	Percent of Forest
Foreground level 1 (Fg1)	216,895	13
Middleground level 1 (Mg1)	466,165	29
Background level 1 (Bg1)	348,793	22
Seldom seen areas level 1 (ss1)	107,712	7
Foreground level 2 (Fg2)	73,607	5
Middleground level 2 (Mg2)	60,604	4
Background level 2 (Bg2)	28,246	2
Seldom seen areas level 2 (ss2)	313,418	19

Note: The acres calculations only include National Forest System lands.

Table 46. Scenic class acres (USDA Forest Service 2015)

Scenic Class	Acres	Percent of Forest
1 - High Public Value	500,767	31
2 - High Public Value	729,587	45
3 - Moderate Public Value	317,349	20
4 - Moderate Public Value	26,399	2
5 - Moderate Public Value	41,317	3
6 - Low Public Value	0	0
7 - Low Public Value	0	0

Note: The acres calculations only include National Forest System lands.

Environmental Consequences

This section evaluates and discloses the potential environmental consequences to scenic resources. The environmental consequences analysis will consider how each alternative provides for scenery management. Criteria for evaluating the potential level of alteration to the landscape are measured by acres of either a visual quality objective or scenic integrity objective on National Forest System lands in each alternative and a qualitative discussion of the potential effects to scenic resources from management activities. Impact indicators for scenery include:

- Whether the scenery management system is being implemented to manage scenery.
- Acres of visual quality objective or proposed scenic integrity objective allocations of each alternative. Existing or proposed plan direction provides for varying amounts of natural-appearing scenery for forest visitors.

Forest Service Scenery Management

The Forest Service visual management system (USDA Forest Service 1974) was used in the 1985 plan. The updated Scenery Management System (USDA Forest Service 1995) was used in this land management plan revision process.[40] Both systems provide a framework to inventory, assess, and manage scenic resources.

In land management plans, both systems establish a spectrum of levels or objectives to determine the acceptable level of alteration in the landscape. Table 47 shows the different levels and describes how people perceive them.

Table 47. Scenic integrity, visual quality objective, and perception crosswalk (USDA Forest Service 1995).

Scenic Integrity (Existing Conditions and Objective)	Visual Quality Objective	The Cibola's Scenic Integrity as People Perceive It
Very high	Preservation (P)	Unaltered; scenic character is intact; naturally evolving
High	Retention (R)	Appears unaltered; alterations to scenic character may be present but are not evident; naturally appearing
Moderate	Partial retention (PR)	Slightly altered; alterations are subordinate to scenic character being viewed (scenic character is dominant, not the alteration); relatively naturally appearing
Low	Modification (M)	Moderately altered; alterations begin to dominate the valued scenic character being viewed.
Very low	Maximum modification (MM)	Heavily altered; alterations may strongly dominate the valued scenic character
Unacceptably low	Unacceptable modification	Extremely altered; this level is only used to inventory existing scenic integrity. It is never an objective on National Forest System lands

Methodology

ArcMap and geographic information system (GIS) data layers were used to do the following:

- analyze 1985 plan and revised draft plan direction for scenic resources (referred to in the 1985 plan as visual resources)
- review scenery management system inventories to determine the existing condition of scenic resources
- develop scenic integrity objectives for the action alternatives
- review proposed management areas and proposed plan components in the revised draft plan
- analyze the alternatives in regards to desired conditions for scenic resources (visual quality objectives or scenic integrity objectives)

Potential effects of management activities were determined through research and analysis of similar projects.

[40] The full methodology, detailed process, and results of the inventories can be found in the Cibola National Forest Scenery Management System inventory process report (USDA Forest Service 2015e).

Assumptions Specific to Scenery

- The principles of scenery management and environmental design will be applied in project-level planning in all National Forest System activities.
- Scenery management techniques and principles will be used to mitigate any future site-specific, land-altering activity or introduced elements on the land to achieve and maintain desired scenic integrity objectives and desired scenic character.
- Scenery management accomplishments and success of mitigation measures in meeting scenic integrity objectives will be measured. Monitoring will be conducted to determine how projects and programs are affecting scenery.
- Changes in scenery and changes in public expectations related to landscape aesthetics and scenery will be monitored and documented (Forest Service Manual 2382 – Scenery Management). Changes in public expectations related to landscape aesthetics and scenery would most likely be monitored at a regional or national level but may also be assessed during scoping for site-specific projects and review of current research when completing scenery analyses for site-specific projects.
- Managing for natural-appearing scenery is important to the public. “Research has shown that high-quality scenery, especially that related to natural-appearing forests, enhances people's lives and benefits society” (USDA Forest Service 1995). “Research shows that there is a high degree of public agreement regarding scenic preferences. This research indicates that people value most highly the more visually attractive and natural-appearing landscapes” (USDA Forest Service 1995).
- Scenery inventory GIS data layers will be reviewed during future project level analysis and updated as ground truthing occurs to keep the data layers accurate and relevant.

Environmental Consequences Common to All Alternatives

Each alternative provides for scenery management to varying degrees, with either visual quality objectives or proposed scenic integrity objectives. Alternative A uses the visual quality objectives established in the 1985 plan. Alternatives B, C, and D use proposed scenic integrity objectives, implementing the scenery management system. The visual quality objective or proposed scenic integrity objective acres for each alternative are summarized in table 48.

Table 48. Scenic integrity objectives and acreage summary across all alternatives

Scenic Integrity Objective	Alternative A VQO Acres (percent)	Alternative B Acres (percent)	Alternative C Acres (percent)	Alternative D Acres (percent)
Very high (unaltered)	139,854 (8%)	193,280 (12%)	143,473 (9%)	342,038 (21%)
High (appears unaltered)	58,677 (3%)	668,905 (41%)	745,665 (46%)	717,887 (44%)
Moderate (slightly altered)	636,893 (34%)	702,120 (44%)	673,330 (42%)	515,605 (32%)
Low (moderately altered)	477,447 (26%)	51,379 (3%)	53,300 (3%)	40,181 (2%)
Very low (strongly altered)	544,219 (29%)	0	0	0

VQO = visual quality objectives

This evaluation will use the term scenic integrity objectives for all alternatives for ease in comparing alternative consequences in this section. More detailed discussion of how the scenic integrity objectives vary by alternative can be found in the sections below. These differences in regards to scenery are discussed further in the environmental consequences for each alternative.

Acres in alternative A are from legacy visual quality objectives polygons for the Cibola. The polygons were delineated in 1981 by grasslands district staff and the Cibola National Forest landscape architect. Revisions to the boundaries were made in 1991 to reflect management decisions outlined in the 1985 plan. Corrections to the data made for this analysis include: designated wilderness areas are managed for the preservation visual quality objective and the visual quality objectives layer was corrected to match this 1985 plan direction.

As shown above, alternative A would have a range of scenic integrity objectives with an emphasis on moderate, low, and very low scenic integrity. Alternatives B and C would have emphasis on high and moderate scenic integrity. Alternative D would have emphasis on high scenic integrity, followed by emphasis of moderate scenic integrity then very high scenic integrity.

Alternative A manages scenery for a more altered condition (levels equivalent to moderate to very low), while alternatives B, C, and D would manage for more natural-appearing scenery (high and very high) than alternative A. Alternative C provides the most high scenic integrity objective (46 percent of the Cibola) and more very high scenic integrity objective than alternative A. Alternative D provides the most very high scenic integrity objective (21 percent) across all the alternatives and also provides about 44 percent of the Cibola in high scenic integrity objective.

General Consequences of Management Activities on Scenic Resources

There is potential for management activities to impact the existing landscape and scenic integrity under all alternatives. Management activities affect scenic resources by altering the appearance of the landscape and include both short-term and long-term effects. Short term and long term would be defined in the project-level analysis based on the potential effects of the activities proposed. Short-term effects for scenery are usually noticeable after project completion and are seen as contrasts to the surrounding natural landscape. Management activities, although they may have some short-term impacts on scenery, also may begin to move the landscape toward the desired scenic character. Effects that move the landscape toward the desired scenic character are often realized over a long period or cumulatively and lead to the lasting sustainability of valued scenery attributes. Project mitigation or design would consider scenic resources under any alternative to meet the visual quality objectives or proposed scenic integrity objectives. It is assumed that, through site specific project design or mitigation, the landscape would move toward scenery desired conditions under all alternatives.

Management activities on the Cibola National Forest with the greatest potential to affect scenic resources are vegetation management (including mechanical treatments and fuelwood collection), prescribed fire, range, transportation infrastructure, and recreation facilities.

There is potential to temporarily impact the existing landscape and scenic integrity from vegetation management activities (including mechanical treatments and fuelwood collection) under all alternatives. Activities including tree removal, depending on the intensity of the treatment, can have varying consequences on scenery. Mechanical treatments could change the character of the landscape where activities occur in the short-term. Fuelwood collection also removes trees, but the impacts would be less noticeable than mechanical thinning type treatments since the activity is usually more localized and at a smaller scale.

Vegetation treatments may have short-term effects of ground disturbance, stumps, and slash. In the long term, if mitigated for scenery, these treatments may provide some preferred scenic settings, such as visual access into the Cibola, large trees, and a smooth herbaceous ground cover. In the long-term, the removal of some trees, dependent on scale and intensity of treatment, may improve scenic character and make scenic attributes more resilient to uncharacteristic large-scale disturbance. Project design, mitigation, or both would consider scenic resources under any alternative so vegetation would meet visual quality objectives or proposed scenic integrity objectives in the short term to the extent possible but particularly in the long term. These types of activities may be most evident in management areas with timber, fuelwood, or restoration emphasis.

Prescribed and managed fire activities would occur under all alternatives. Treatments to restore fire-adapted ecosystems vary and include use of prescribed fire as well as wildland fire use. All fire activities would be evident in the short term with burned, blackened vegetation, and charred ground surfaces. Grasses and shrubs typically recover quickly, depending on when treatment occurs and moisture conditions during the growing season. In the long term, prescribed fire usually increases the diversity of texture, color, vegetative size classes, and distribution across the landscape. In the long term, prescribed fire at lower intensities creates preferred scenic settings and increases sustainability of scenic character. These types of activities may be most evident in management areas with fire or conservation emphasis.

Range management would continue under all alternatives. It is anticipated that change in vegetative cover from on-going grazing would meet desired conditions for range and vegetation types; therefore, also meeting desired conditions for scenery. In places with the most range activities, views may include windmills, cattle, stock tanks, fences, and other private ranchland features. These facilities are typically small and localized being subordinate to the scenic character, and with some mitigation for scenery such as using colors that blend with the natural landscape, would have minimal effects on, or help contribute to, scenic character of the landscape. Many local residents are accustomed to viewing these structures and features and consider them a highly valued part of the traditional landscape. Visitors may also have an appreciation of the rural or pastoral character of these landscapes. For many residents and some visitors, the presence of this activity contributes to the sense of place or cultural identity of these areas. These activities would be most evident in management areas with range emphasis.

Recreation activities, both developed and dispersed, would continue in all alternatives. Developments for recreation activities are evident, such as roads, trails, and campground and trailhead facilities, and they are appropriate for the recreation opportunity spectrum setting (generally rural and roaded natural). The recreation opportunity spectrum incorporates the naturalness of scenery as one of the variables of the setting characteristics. Facilities may be evident and noticeable, creating a built environment to an otherwise natural environmental setting. When facilities are designed to blend with the surrounding landscape, they have minimal effects to scenery. When best environmental and sustainable design practices are used, facilities can harmonize with the surrounding landscape or enhance and complement the surrounding scenic character. Additionally, recreation facilities that conform to the cultural landscape are also appropriate in high scenic integrity areas in rural or roaded natural settings. The location of facilities affects the surrounding setting because they raise the level of concern by becoming viewing platforms for visitors.

Roads-related activities, such as road maintenance or decommissioning, would continue under all alternatives. Decommissioning of roads could create noticeable soil color contrasts in foreground views of the concern level travel routes and use areas. In the short term, these areas visually recover quickly as the area revegetates. In the long term, road decommissioning is typically beneficial to scenery resources by recontouring slopes to mimic natural landforms and rehabilitating and revegetating exposed soils typically noticeable on cut and fill slopes created during road construction.

Environmental Consequences – Alternative A~~n~~

All current management areas and designated areas would continue to exist as they are described in the 1985 plan. All 18 areas would continue to provide distinct management emphasis. When the Cibola plan was adopted in 1985, scenic resources were inventoried and analyzed using the visual management system (USDA Forest Service 1974). This system established standards of measurement (visual quality objectives) for assessing proposed and existing impact to scenic resources. Maps of visual quality objectives for each district were provided in volume 2 of the assessment (USDA Forest Service 2015b). However, these maps did not fully reflect current management direction for all areas of the Cibola National Forest such as designated wilderness areas, which are managed for preservation visual quality objective.

Using the visual management system, most of the Cibola (about 55 percent) would be managed with visual quality objective of modification or maximum modification, where the valued scenic character appears moderately to strongly altered, deviations begin to dominate, and disruptive activities may occur. About 34 percent of the Cibola is assigned a visual quality objective of partial retention where the valued scenic character appears slightly altered and deviations must remain visually subordinate. About 11 percent of the Cibola is assigned visual quality objectives of preservation or retention, where the management emphasis would maintain or enhance the valued scenic character. Overall, scenic resources would be maintained at a lower scenic integrity than the action alternatives because of the greater acreage in the modification and maximum modification visual quality objectives (equivalent low and very low scenic integrity levels).

The 1985 plan also includes standards and guidelines related to vegetation management near roads, trails, and recreation sites with retention and partial retention visual quality objective (USDA Forest Service 1985a). The roads, trails, and recreation sites providing the basis for these visual quality objectives are based on inventories completed in the 1980s. During and following the assessment, the interdisciplinary team identified areas where the inventoried visual quality objective is much lower than it would be using the scenery management system inventory process and does not accurately reflect the existing concern for scenery. For example, in the 1985 plan, the Magdalena Ranger District's Sawtooth Mountains are identified as maximum modification visual quality objective, which provides limited protection for the scenic resources. Through the scenery management system inventory process, the Sawtooth Mountains have been identified as a concern level 1 (assigned to areas where visitors have a high concern and interest in scenery) with a high existing scenic integrity due to the naturalness and majesty of these unique sandstone escarpments and cliffs. Another example is the Continental Divide National Scenic Trail located on the Mt. Taylor Ranger District. Under the 1985 plan, most of the trail passes through modification visual quality objective, which also provides limited protection for scenic resources within the viewshed from the trail. This nationally significant trail would also be a concern level 1 route using the scenery management system inventory process. The above are just a few examples and may be common across the Cibola National Forest. Continuing to manage scenic resources based on the inventories completed in the early 1980s, does not reflect the increased concern for scenery evidenced in increased recreation use, national visitor use monitoring reports, and expectations for variety and natural appearing scenery identified by the public during the land management planning process.

The 1985 plan direction for visual resources does not incorporate the ecosystem management concepts into scenery management, making it difficult for managers to work toward an improved scenic resource condition. For example, healthy, fire-resistant vegetation (for example, vegetation conditions allowing fires to move through the landscape without doing major damage and that recover relatively quickly from fire) is important for long term scenic quality and scenic character resilience. The 1985 plan also contains direction for projects that are no longer needed or feasible with current funding, such as recommendations for viewshed corridor plans and an inventory of visual absorption capability (USDA Forest Service 1985a). These recommendations are no longer Cibola National Forest priorities or are inconsistent with the current best practices in managing scenic resources.

Visual quality objective maps would continue to be used during project planning. The visual quality objective maps do not reflect changes in visitor use patterns, do not incorporate views from trails, do not reflect current public opinion (especially concerns about community backdrops and scenery), and do not reflect an ecosystem management landscape context. Additionally, visual quality objectives do not recognize the cultural importance of some human modifications including historic sites, well-designed buildings (such as visitor centers), and manmade features such as campgrounds. Therefore, visual quality objectives do not provide adequate guidance for protecting scenic quality or moving toward desired conditions over the life of the plan.

Environmental Consequences Common to Action Alternatives, B, C, and D

During the development of the proposed revised plan, a full inventory of scenic resources was conducted using the scenery management system. As part of the interdisciplinary revision process, proposed scenic integrity objectives were developed from the scenery management system inventories and integration with other resources. Under all action alternatives, the scenery management system would be fully implemented including desired conditions, objectives, standards, or guidelines to manage scenic resources.

The conversion from visual management system to scenery management system in the action alternatives aligns with current Forest Service policy and is consistent with a shift to ecosystem management benefits and principles and ecological restoration. Activities such as prescribed fire and large-scale vegetation management activities to restore ecosystem functions are examples of management activities that illustrate the benefits of a longer-term scenery management philosophy. These activities may have visually dominant effects in the short term, such as ground disturbance, stumps, or slash, which may be out of step with adopted scenic integrity objectives. However, these activities also would begin to move the landscape toward the desired conditions for scenic resources over the long term. Ultimately this would typically provide for more positive scenic elements such as variety, larger trees, and healthier, more resilient vegetation over the life of the plan and result in the lasting sustainability of valued scenery attributes, such as clear lakes and streams, vegetative ground cover, large trees, mosaic of conifer forests and aspen or meadows, open mid-story canopy with high visual penetration and vistas with distant views and high topographic relief to name a few (Gobster 1994).

Environmental Consequences – Alternative B - Site-Specific Emphasis

Alternative B would manage scenic resources under a mix of proposed scenic integrity objectives with emphasis on moderate (44 percent) to high (41 percent) scenic integrity with some very high (12 percent) scenic integrity. Alternative B proposes the most moderate scenic integrity objective when compared to other alternatives and more high and moderate scenic integrity objective than alternative A. The Cibola National Forest would be managed for natural-appearing, intact scenic character across most of its landscapes.

This distribution of scenic integrity objectives would result in more of the Cibola being managed for more natural and natural-appearing scenic character than alternative A providing an intact and attractive scenic setting for forest visitors and residents. This would maintain or improve visitor satisfaction and contribute to a higher quality visitor experience than alternative A for those visitors expecting to recreate in natural and natural-appearing scenic character.

Alternative B includes desired conditions, standards, and guidelines for scenic resources, which provide integrated resource management direction and result in sustainability of valued scenic attributes and scenic character resiliency to changing conditions and provide opportunities for visitors to connect with nature. Views from concern level travelways and use areas are emphasized to enhance recreation settings and meet the public expectations for scenic resources in the long term.

In addition to forestwide plan components, there are unique plan components for 10 proposed site-specific management areas in alternative B. Proposed management areas described as having unique scenery and scenery related plan components include Mount Taylor, Guadalupe and Little Water Canyon (Mount Taylor Ranger District) and Fourth of July Canyon (Mountainair Ranger District). This alternative also includes the Silver Hill Dark Skies Management Area (Magdalena Ranger District). Dark sky values are often closely linked to scenic resources as an important part of scenic character.

Plan components for designated areas include managing inventoried roads areas as high scenic integrity objective, eligible wild and scenic rivers with a scenic integrity objective determined by potential classification, nationally designated trails and scenic byways with high scenic integrity in foreground viewsheds. Alternative B also recommends 55,779 acres for wilderness designation with very high scenic integrity objective. Overall there are more lands proposed to manage for high (41 percent) and very high (12 percent) scenic integrity objective when compared to alternative A.

Mechanical treatments and fuelwood permits would occur under this alternative with levels equal to alternatives A and D and less than alternative C. Alternative B proposes more prescribed fire than alternative A and less than alternative C. Alternative B proposes to relocate, improve, or decommission system roads or unauthorized routes at levels greater than alternative A. Potential consequences of these types of management activities are in the "General Consequences of Management Activities on Scenic Resources" section above. These and other management activities would be designed to meet the allocated distribution of scenic integrity objectives per the forest wide scenic resources standard that scenery management, scenic character, and scenery values are integrated into the design, planning, and implementation of all resource management decisions.

Environmental Consequences – Alternative C

Alternative C would manage scenic resources under a mix of proposed scenic integrity objectives with most emphasis on high (46 percent) and moderate (42 percent) scenic integrity and less emphasis on very high (9 percent) scenic integrity. The Cibola National Forest would be managed for natural-appearing, intact scenic character across most of its landscapes. This distribution of scenic integrity objectives would have effects similar to alternative B.

Alternative C includes desired conditions, standards, and guidelines for scenic resources, which provide integrated resource management direction and result in sustainability of valued scenic attributes and scenic character resiliency to changing conditions and provide opportunities for visitors to connect with nature. Views from concern level travelways and use areas are emphasized to enhance recreation settings and meet the public expectations for scenic resources in the long term.

In addition to forestwide plan components, there are plan components for two purpose-based conservation and restoration management areas in alternative C. The conservation management area emphasizes unique opportunities for protecting and enhancing values such as solitude, scenic integrity, and socioeconomic opportunities that emphasize backcountry and primitive recreation. The conservation management area would be managed for high scenic integrity. Conservation management areas are proposed on the Mt. Taylor and Magdalena Ranger Districts. Magdalena Ranger District has two conservation management areas and Mt. Taylor Ranger District has one area (includes and replaces place-based Guadalupe Management Area from alternative B).Restoration management areas are proposed on all districts. More mechanical treatments and fuelwood permits would occur under this alternative than any of the other alternatives (alternatives A, B, or D). Consequences previously described for these types of management activities would be most evident in the restoration management area (see "General Consequences of Management Activities on Scenic Resources" section). Although emphasis would be on intensive management, specifically on mechanical thinning, management activities would be designed to meet the allocated distribution of scenic integrity objectives per the forestwide scenic resources standard that scenery management, scenic character, and scenery values are integrated into the design, planning, and implementation of all resource management decisions.

Plan components for designated areas are the same as alternative B. Alternative C recommends 24,265 acres for wilderness designation with very high scenic integrity objectives. Overall, there are more lands proposed to manage for high (46 percent), more lands proposed to manage for moderate (42 percent), and slightly more very high (9 percent) scenic integrity objective when compared to alternative A.

Alternative C proposes the most prescribed fire but the least management by naturally ignited wildfires. Alternative C proposes to relocate, improve, or decommission more system roads or unauthorized routes (3 to 5 miles annually) than any other alternative than alternatives A and B. Potential consequences of these types of management activities are in the "General Consequences of Management Activities on Scenic Resources" section above.

Environmental Consequences – Alternative D

Alternative D would manage scenic resources under a mix of proposed scenic integrity objectives and would have emphasis on high (44 percent) scenic integrity, followed by moderate (32 percent) scenic integrity and very high (21 percent) scenic integrity. The Cibola National Forest would be managed for natural-appearing, intact scenic character across most of its landscapes. This distribution of scenic integrity objectives would result in more of the Cibola being managed for intact, naturally evolving scenic character than other alternatives.

Alternative D emphasizes backcountry and primitive recreation by decreasing the intensity of restoration treatments. Alternative D includes the most area of recommended wilderness of all alternatives: 203,117 acres. Alternative D has the most lands proposed to manage for very high (21 percent) scenic integrity objective when compared to the other alternatives, corresponding to designated wilderness areas and recommended wilderness areas in this alternative. Less acreage in moderate scenic integrity reflects the alternative's emphasis on primitive recreation and the use of wildland fire as a vegetation management tool. Fewer deviations from natural character would occur in alternative D, resulting in more undisturbed scenic vistas than other alternatives, but also in the least amount of recreational amenities and developed areas due to primitive recreation emphasis.

Alternative D includes desired conditions, standards, and guidelines for scenic resources which provide integrated resource management direction and result in sustainability of valued scenic attributes and scenic character resiliency to changing conditions and provide opportunities for visitors to connect with nature. Views from concern level travelways and use areas are emphasized to enhance recreation settings and meet the public expectations for scenic resources in the long term.

There are no proposed site-specific management areas or purpose based conservation or restoration management areas in alternative D. Management area direction for eligible wild and scenic rivers management areas is the same as alternative B.

Alternative D proposes mechanical treatments and fuelwood permits at the same amount as alternatives A and B. Alternative D proposes the same amount of prescribed fire as alternative B but the most management by naturally ignited wildfires. Alternative D proposes to relocate, improve, or decommission system roads or unauthorized routes at the same rate as alternative B. Potential consequences of these types of management activities are in the "General Consequences of Management Activities on Scenic Resources" section above. Similar to alternatives B and C, these and other management activities would be designed to meet the allocated distribution of scenic integrity objectives per the forestwide scenic resources standard that scenery management, scenic character, and scenery values are integrated into the design, planning, and implementation of all resource management decisions.

Cumulative Environmental Consequences

The cumulative effects analysis timeframe for scenic resources is the next 10 to 15 years, and the analysis area is the Cibola National Forest and lands adjacent to and lands within the Cibola National Forest under other ownership. Cumulative consequences are those consequences of past, present, and foreseeable activities on lands of other ownership that, in conjunction with management activities likely to occur on the Cibola National Forest, may intensify, negate, improve, or otherwise affect scenic resources. The Cibola National Forest shares borders with private land, Albuquerque Open Space, State of New Mexico, Bureau of Land Management, tribal lands, Department of Defense, and other municipalities.

Any planning direction for other ownerships that consider scenic or visual resources or related resources (such as open space or aesthetics) during management complement scenery management on National Forest System lands by providing a similar level of scenic resource consideration across ownership boundaries. Some management on adjacent lands complements the scenery management of the Cibola National Forest including lands managed by Albuquerque as open space and lands managed by Bureau of Land Management, which uses a visual resource management system. Counties with open space or scenery-related language in guiding documents or plans also complements scenery management of the Cibola across ownership boundaries. Agencies which do not manage for scenery, such as the Department of Defense, may have noticeable differences in levels of development across boundaries that could impact the scenic quality in areas viewed from scenic byways and nationally designated trails.

State of New Mexico manages State trust lands to optimize economic benefit for the trust beneficiaries (including schools, universities, hospitals, and public institutions). While these lands permit public access, they are not managed like other public lands such as national forests or national parks. As these lands are managed, leased, or auctioned, scenic resources may or may not be considered in that action. If scenic resources are not considered, effects would be similar to those described below.

Since most private lands and lands of other ownership do not have regulations for scenic resource management, the effects of ongoing developments next to National Forest System lands can sometimes have negative effects on scenic resources when viewing the continuous landscape. Forest visitors often view scenery as a continuous landscape with little discernment regarding the land ownership being viewed. Sometimes management activities occurring on ownership boundaries can be quite noticeable if the change in form, line, color, or texture of the activity follows ownership boundaries rather than a natural landscape feature. If activities on private lands are designed to lessen impacts to scenic resources, the difference between private lands and National Forest System lands are less apparent. The regional, county, and community plans inclusion of scenic or aesthetic resources or open space character helps promote the management and value of scenic resources across ownership boundaries in the cumulative consequences analysis area.

Natural resources and settings would be vulnerable to adverse effects of atypical temperatures and rainfall patterns from climate change. Some associated effects include drought, increased number and intensity of wildfires, increased insect and disease outbreaks affecting vegetation, and decreased water yield and availability. Severe wildfires would remove forest vegetation and diminish the scenic quality of the landscape, especially when a wildfire burns at an uncharacteristic scale or severity. When fires burn at high intensities over large areas, as is more likely during severe drought and increased temperatures, heavy runoff from extreme storms may remove understory vegetation, which would reduce the quality of scenic vistas. When insect and disease outbreaks occur at epidemic levels, tree mortality with standing and fallen dead trees would reduce scenic quality especially when the mortality dominates scenic vistas. Defoliation of trees from insects and disease would also affect the scenic quality changing the scenic views while trees are defoliated.

Infrastructure

This section summarizes the existing national forest road system and facilities infrastructure on the Cibola National Forest. It evaluates and discloses potential environmental consequences of proposed alternatives on the national forest road system. It describes existing conditions and examines four alternatives for revising the 1985 plan (USDA Forest Service 1985a). Motorized trails are addressed in the “Recreation” section.

Affected Environment

National Forest Road System

The national forest road system for the Cibola is defined as the National Forest System roads on National Forest System lands (36 CFR 212.1). This section covers existing conditions of the National Forest System roads. National Forest System trails, recreation site access, and effects are evaluated in the recreation section.

National Forest System roads are roads under Forest Service jurisdiction, within or adjacent to the national forest that are necessary for protection, administration, resource development and product utilization. Roads managed by public agencies such as states, counties and municipalities that provide access to National Forest System lands are also considered part of the overall regional national forest road system but do not fall under Forest Service jurisdiction. Roads under other jurisdiction are not included in this evaluation.

The national forest road system on the Cibola consists of roads that provide access to public lands and to private in-holdings. The road system provides access for administration, recreation, vegetation management, wildland fire management, livestock grazing management, habitat restoration, natural resource development, utility corridor and communication site development and maintenance, minerals management and use, as well as monitoring activities.

Motorized travel on the Cibola has evolved over time. Historically, the road system on the Cibola National Forest was constructed for administration and product removal, primarily timber and mining, and for administration of livestock grazing permits. The national forest road system continues to provide access for administration of the Cibola; however, most current use is from public recreation and national forest management.

National Forest Service System roads are designated by the designed use (vehicle classifications and amount of traffic), which determines the maintenance level. Maintenance levels are defined by Forest Service Handbook 7709.58,10,12.3 as the level of service provided by, and maintenance required for, a specific road. Maintenance levels must be consistent with road management objectives, and maintenance criteria.

The Forest Service has five road maintenance levels to define the level of service provided and design vehicle usage. There are no maintenance level 5 roads on the Cibola. The four maintenance levels present are described below. A complete description of road maintenance levels is included in the glossary.

- Maintenance level 1 roads are roads that have been placed in storage between intermittent uses. The period of storage must exceed 1 year. Basic custodial maintenance is performed to prevent damage to adjacent resources and to perpetuate the road for future resource management needs. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Appropriate traffic management strategies are "prohibit" and "eliminate" all traffic. These roads are not shown on motor vehicle use maps.

  Roads receiving level 1 maintenance may be of any type, class, or construction standard, and may be managed at any other maintenance level during the time they are open for traffic. However, while being maintained at level 1, they are closed to vehicle traffic but may be available and suitable for nonmotorized uses.

- Maintenance level 2 is assigned to roads open for use by high-clearance vehicles. Passenger car traffic, user comfort, and user convenience are not considerations. Warning signs and traffic control devices are not provided with the exception that some signing, such as W-18-1 “No Traffic Signs,” may be posted at intersections. Motorists should have no expectations of being alerted to potential hazards while driving these roads. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Log hauling may occur at this level.

- Maintenance level 3 is assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. The Manual on Uniform Traffic Control Devices (MUTCD) is applicable. Warning signs and traffic control devices are provided to alert motorists of situations that may violate expectations.

  Roads in this maintenance level are typically low speed with single lanes and turnouts. Appropriate traffic management strategies are either "encourage" or "accept." "Discourage" or "prohibit" strategies may be employed for certain classes of vehicles or users.

- Maintenance level 4 is assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. However, some roads may be single lane. Some roads may be paved, dust abated, or both. Manual on Uniform Traffic Control Devices is applicable. The most appropriate traffic management strategy is "encourage." However, the "prohibit" strategy may apply to specific classes of vehicles or users at certain times.
- Maintenance level 3 and 4 roads are collectively maintained for travel by a prudent driver in a standard passenger car. Maintenance level 1 roads require the least amount of maintenance and maintenance level 4 is the highest level on the Cibola national forest road system. Maintenance level 1 roads are closed to all motorized travel. Maintenance level 2, 3, and 4 roads are open to motorized vehicle traffic. Open system road miles include some roads with seasonal access restricted. System roads may be closed during extreme weather conditions for public safety and to minimize resource damage.

There are 3,129 miles of National Forest System roads and 9 bridges on the Cibola National Forest. Forest system roads do not include private roads or roads that are under State or County jurisdiction or under other local public road authority. Table 49 displays the number of road miles by maintenance level for each mountain district.

Table 49. Road miles by maintenance level

Ranger District	ML 1	ML 2	ML 3	ML 4	Total Miles
Mt Taylor	219.2	891.6	97.1	0.6	1,208.5
Magdalena	48.4	1,204.5	103.5	0.2	1,356.6
Mountainair	5.2	421.1	58.4	0.0	484.7
Sandia	16.3	46.8	6.0	10.0	79.1
Total	289.1	2,564.0	265.0	10.8	3,129

ML = maintenance level

Additional travelways exist that are not part of the National Forest System road network and are considered unauthorized routes. These unauthorized routes include unplanned, abandoned travelways, user created routes and roads that were under permit or other authorization that were not decommissioned when the authorization was terminated. Travelways in this category would be analyzed during project-level environmental planning for addition to the system or to be decommissioned if not needed for future management.

Roads may be permanent, if intended for long-term use, or they may be temporary for a one-time use and then decommissioned. Any adjustments to the national forest road system would be made using appropriate site-specific planning under the National Environmental Policy Act. Very little new system road construction is anticipated. Temporary roads could be used for forests products removal where permanent roads are not needed for long-term future access.

Travel planning is used to identify the minimum road system (36 CFR 212(b) (1)) (subpart A) needed for safe and efficient travel and for administration, utilization, and protection of National Forest System lands. This travel planning process has been completed for the mountain districts but may be revisited on other bases.

Regulations at 36 CFR 212 subpart B require all Forest Service units to designate a system of National Forest System roads, National Forest System trails, and areas on National Forest System lands for motor vehicle use and to publish this designated system of roads, trails, and areas on a motor vehicle use map.

The Travel Management Rule (November 9, 2005, 36 CFR Parts 212, 251, 261 and 295) requires each national forest to designate a road and trail system and areas for motor vehicle use by vehicle class and, if appropriate, by time of year. The rule addresses any future proliferation of unauthorized routes by prohibiting cross-country motorized travel, except in designated areas and by written authorization. Designation of specific routes, trails, and areas for motorized vehicle travel is not considered or analyzed during land management plan revision. It is addressed under a separate motorized travel planning effort on the Cibola National Forest. Motorized vehicle travel has been analyzed in separate environmental assessments by each District.

Over the last few decades, funding has not been sufficient to maintain all National Forest System roads to appropriate standards to meet road management objective level. Road maintenance budgets have declined over the last several years. The average road maintenance budget to maintain Cibola mountain district system roads in recent years is approximately 19 percent of funding needs. Limited funding has been focused on maintaining the higher standard roads that serve multiple access needs. This reduced fiscal capacity for maintenance may adversely affect future sustainability of the current national forest road system on the Cibola.

Routine road maintenance (roadside brushing, surface blading, and other activities to maintain drainage functionality, such as ditch and culvert cleaning, etc.) is periodically performed on maintenance level 2, 3, and 4 roads as funding allows to keep the roads in a drivable condition and to minimize resource damage. Maintenance level 1 roads do not receive routine maintenance work. Drivability of these maintenance level 1 roads can be expected to diminish as roads may revegetate between intermittent use. Drivability would be restored when the roads are needed for future management access.

There currently is a backlog of deferred road maintenance due to reduced funding. The failure to perform needed repairs could lead to road deterioration and impacts on adjacent resources.

Road maintenance will continue, as funding allows. Maintenance funding allocation will be based on public health and safety, resource protection, and mission priorities.

Facilities

Cibola National Forest facilities include four mountain district offices, quarters for seasonal employees and crews, warehouses, barns, residential housing, storage facilities, water and wastewater systems (both administrative and recreational), dams, and communication sites. Developed recreation site buildings descriptions and analysis are included in the "Recreation" section of this draft environmental impact statement.

A facility master plan for the Cibola National Forest was completed in 2014. The facility master plan guides funding strategy, acquisition, maintenance, and disposal of administrative facilities. It identifies facility needs and guides decisions regarding proposed and existing facilities. Existing structures at the supervisor's office and at each district are described in the facility master plan (USDA Forest Service 2014a). Existing facilities condition are rated as good, fair, or poor based on the facility condition index described in the plan. Facilities are grouped by maintenance level, used to allocate available maintenance funding. The plan is reviewed annually and amended when necessary.

This facility master plan does not include an analysis of the forest transportation network, recreation facilities, or special use facilities (USDA Forest Service 2014a). Over the past several years, management emphasis has been to reduce the square footage of administrative facilities to reduce maintenance costs and still meet Cibola National Forest management needs.

The water and wastewater systems are rated as good, fair, or poor with the majority in poor condition (1 administrative and 6 recreational). Management emphasis has been focused on the systems with the highest use in addition to reduction of maintenance costs while meeting Cibola National Forest needs. Since most of these systems are on recreation sites, the development of the recreation site analysis will prioritize recreation system maintenance and provide direction for potential system decommissioning.

Dams are ranked for hazard classification as either high, medium, or low risk based on design and location factors. This ranking contributes to the frequency of inspection cycle. The regional dam engineer inspects and rates the dam's condition as either good, fair, or poor. Management emphasis is focused on dam ranking and condition rating and is addressed at regional level planning and management.

Environmental Consequences

Methodology and Analysis Process

Information used to conduct the analysis generally is from the national infrastructure database. This database is a collection of web-based data entry forms, reporting tools, and mapping tools (geographic information system) that enable forests to manage and report accurate information about their inventory of constructed features and land units.

Additional information is from the Cibola transportation infrastructure assessment, the Cibola ranger district transportation analysis process reports, the Cibola 2016 facilities master plan, and from Cibola GIS data. GIS is a spatial tool and is linked to the Infra database. The data includes miles of roads, maintenance levels of roads, road features (culverts, grade dips, cattleguards, etc.), road management objectives, and maintenance items. This data reflects all National Forest System roads and administrative facilities and how Cibola National Forest personnel have been managing the road system and administrative facilities.

The geographic scope of the analysis is the land administered by Cibola National Forest personnel. All lands within the Cibola's boundaries form the geographic scope for cumulative effects, and the temporal scope is the life of the plan (15 years).

Effects Indicators

- System road and unauthorized road miles decommissioned or treated to improve ecological system health
- System road miles receiving maintenance, reconstruction work, or both
- Facilities maintenance, address high-risk conditions in facilities (accessibility, safety hazards, environmental compliance, water systems, etc.)
- Reducing risk to facilities from wildland fire through mechanical and prescribed fire vegetation treatments

Assumptions

- None of the alternatives have specific objectives during the life of the plan to construct new National Forest System roads. The environmental consequences of any proposed new motorized route construction or designation of new motorized areas would be identified and analyzed at the project level.
- No new motorized routes would be constructed in designated wilderness areas, inventoried roadless areas, or other areas not suitable for motorized travel.
- System and (unauthorized roads) not needed for future use would be analyzed at project-level planning for decommissioning. Decommissioning methods, to restore the road to a more natural state, would be determined at project level analysis.
- Site-specific resource concerns on suitable timber management areas and areas available for other wood products are not addressed at this forest-scale planning. Site-specific attributes related to transporting products would be identified and analyzed in project-level planning.
- There are no planned changes to existing travel management decisions under this plan revision effort.

The land management plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carryout any project or activity. Because the land management plan does not authorize or mandate any site-specific projects or activities (including ground-disturbing actions), there would be no direct effects. However, there may be implications, or long term environmental consequences, of managing the Cibola under this programmatic framework.

Alternative effects on the national forest road system for treatment area access are compared to routine annual maintenance of 230 system road miles annually (alternative A). Effects of road maintenance, drainage improvements, reconstruction, realignment, relocation, or decommissioning would:

- reduce sediment transport and improve water and soil quality to support ecological resilience;
- provide safe public and administration access to National Forest System land;
- improve economics in the area by providing access for timber harvest, wood cutting, range, minerals and other forest product uses, with beneficial impacts on local economies to benefit economic resilience; and
- provide improved, more efficient opportunities and access for recreation to benefit sustainable recreation.

Alternative effects on the facilities are compared to routine or recurrent annual maintenance of 65 percent of facilities risks annually. Effects of facilities improvements would:

- provide safe access for public and administrative use;
- provide community support (safe access for information-permits-meetings);
- improve the economy by hiring local contractors to benefits economic resilience;
- reduce risk to facilities through vegetation treatment and fuel reduction; and
- reduce facilities deferred maintenance needs.

Environmental Consequences Common to All Action Alternatives B, C, and D

National Forest Road System

The desired conditions in the draft land management plan are the same across alternatives B, C, and D and are based on ensuring that the national forest road system and infrastructure are sufficient to support appropriate multiple uses of the Cibola National Forest. A safe national forest road system would accommodate needs for public access, land management, resource protection, permitted activities, and be cost effectiveness; while contributing to social, economic, and ecological sustainability.

Alternatives B, C, and D all contain direction for roads that include specific maintenance and decommissioning objectives within the planning period. Land management plan implementation will not serve as or avoid the travel analysis process. All roads to be decommissioned may not result in a decrease of system road miles, due to the inclusion of unauthorized nonsystem roads. Only system roads would be relocated and improved or decommissioned. Unauthorized routes would just be decommissioned. All national forest system road construction, maintenance, and decommissioning would be done in accordance with applicable Forest Service handbooks and manuals, standards and guidelines, best management practices (Forest Service Handbook 2509.22 - Soil and Water Conservation Practices Handbook, FS-990A), laws, regulations, and policy. Road decommissioning would achieve travel management (36 CFR part 212, subpart A) directions for a minimum road system, reduce road density, recreate and stabilize the natural pre-road terrain features, remove roads as potential sources of surface runoff, erosion and sediment delivery to improve soil and water quality. Road decommissioning would be analyzed with public input, at project-level planning under National Environmental Policy Act regulations.

Both mechanical and prescribed fire for vegetation treatments are planned for all alternatives. Mechanical treatments may require system road reconstruction (for example, curve widening, hardened drainage crossings) and temporary road construction for vehicles and equipment access needed to perform mechanical treatment. Temporary roads would not be a permanent part of the road system. Temporary roads are nonsystem routes which are intended to be used for a project and then decommissioned after use. Temporary road construction would include vegetation clearing, excavation, blading and shaping. Unlike permanent roads, temporary roads would only have the minimal investment and drainage required to minimize resource impacts while providing for safe haul vehicle use during the short road life for a specific project. Temporary road obliteration would include removing any culverts, restoring natural drainage, eliminating ditches, subsoiling and out-sloping the roadbed if needed, removing ruts and berms, placing slash, stumps and effectively blocking the road to motor vehicular travel. Areas disturbed by temporary roads would return to a more natural condition after project operations are complete. Mechanical vegetation treatments could have higher cost per acre due to motorized access needs compared to prescribed burning.

System road improvements; maintenance, reconstruction, relocation, realignment, decommissioning and other needed work, associated with mechanical vegetation treatments, would reduce sediment transport and improve water and soil quality to support ecological resilience. Road improvements would provide safe access to National Forest System land, support the economy through timber harvest, fuelwood cutting, range use, minerals, and other forest product access that benefit economic resilience; while improving access and opportunities for sustainable recreation.

Vegetation restoration treatments and fuel and fire risk reduction would support communities and provide safe access for public and administrative use. National forest road system protection and maintenance, implemented for vegetation treatment projects, would enhance access and support the local economy by contracting recurrent and deferred maintenance work.

Facilities

Within the draft land management plan, the desired conditions for facilities are the same across all alternatives and are based on ensuring facilities are safe, well maintained, sustainable, energy efficient, accessible, functioning as intended or are adapted to accommodate current and anticipated demands. Facility risk abatement varies among alternatives. Variability is mainly a result of vegetation treatment area location, fuel load management, and fuel reduction work variability that might be accomplished under the four alternatives. Both mechanical and prescribed fire vegetation treatments are planned under all alternatives.

Vegetation treatment effects, fuel and fire risk reduction, would provide safe access for administrative and public use (information, permit acquisition, meetings, and other visitor needs). Facilities protection and maintenance would support the local economy by contracting recurrent and deferred facility maintenance work.

Alternative Actions

Alternative actions related to infrastructure are displayed in table 50 and table 51.

Table 50. Comparison of national forest road system alternative actions that affect infrastructure

Effects Measure	Alternative A	Alternative B	Alternative C	Alternative D
Relocate, reconstruct, improve system roads and/or decommission unneeded system roads and unauthorized roads to protect ecosystems and watersheds	1 mile per year	1 to 3 miles per year	3 to 5 miles per year	1 to 3 miles per year
Road maintenance and improvements needed to mechanically treat vegetation and fuels including timber harvest	2,000 to 5,000 acres per year	2,000 to 5,000 acres per year	2,800 to 7,000 acres per year	2,000 to 5,000 acres per year
Road maintenance and improvements needed to provide fuelwood	9,000 to 12,000 cords per year	9,000 to 12,000 cords per year	12,000 to 15,000 cords per year	9,000 to 12,000 cords per year
Prescribe burn (reduce risk to national forest road system)	3,500 to 10,000 acres per year	4,200 to 12,000 acres per year	4,900 to 14,000 acres per year	4,200 to 12,000 acres per year
Manage naturally ignited wildfires (reduce risk to national forest road system)	2,000 to 5,000 acres per year	2,200 to 5,500 a acres per year	2,400 to 6,000 acres per year	2,200 to 5,500 acres per year
No road access would be needed in recommended additional wilderness areas	0	55,779 acres	24,265 acres	203,113 acres

Table 51. Comparison of facilities alternative actions that affect infrastructure

Effects Measure	Alternative A	Alternative B	Alternative C	Alternative D
Reduced risk to facilities, mechanically treat vegetation on highly departed areas	2,000 to 5,000 acres per year	2,000 to 5,000 acres per year	2,800 to 7,000 acres per year	2,000 to 5,000 acres per year
Reduced risk to facilities with prescribe burns to restore vegetation conditions	3,500 to 10,000 acres per year	4,200 to 12,000 acres per year	4,900 to 14,000 acres per year	4,200 to 12,000 acres per year
Reduced risk to facilities with managed naturally ignited wildfires	2,000 to 5,000 acres per year	2,200 to 5,500 a acres per year	2,400 to 6,000 acres per year	2,200 to 5,500 acres per year

Environmental Consequences – Alternative A

National Forest Road System

Under alternative A, national forest system road management would continue under management-area-specific goals, objectives, standards, and guidelines in the 1985 plan (as amended), which were driven primarily by timber harvest, livestock production, mining, recreation, and administration access.

Mechanical fuel treatment would be implemented on 2,000 to 5,000 acres each year and 9,000 to 12,000 cords of fuelwood would be available for public use. In addition to the 230 miles of system road annual maintenance, up to one mile of system road would be reconstructed, relocated, improved, or roads not needed for future management including unauthorized routes would be decommissioned annually to facilitate access for mechanical vegetation treatment, fuelwood and other products removal, administration and recreation use. Effects of road decommissioning would be considered at project-level planning. Road improvement work with best management practices would improve water quality, soil productivity, and access for recreation, administration and other resource needs.

Road improvements under alternative A would be similar to that under alternatives B and D but less than under alternative C.

Facilities

Under alternative A, facilities management would continue under management-area-specific goals, objectives, standards, and guidelines in the 1985 plan (as amended). The 1985 plan anticipated ongoing maintenance, replacement, and new facilities. The facility master plan (2014) provides guidance for the acquisition, maintenance, and disposal of administrative facilities.

Risk to facilities would be reduced with mechanical vegetation and fuel treatments and prescribed fire. Under alternative A, 2,000 to 5,000 acres of fuel would be mechanically treated each year. Fire risk to facilities would also be reduced with prescribed burning and wildfire management. Under alternative A, 3,500 to 10,000 acres would be prescribe burned and 2,000 to 5,000 acres would be managed with wildfire annually.

Annual facilities work is planned to maintain 65 percent of high risk and necessary conditions for accessibility needs, safety hazards, environmental compliance, water systems, and other condition needs to standards.

Environmental Consequences – Alternative B

National Forest Road System

Desired vegetation conditions would be maintained with a balance of mechanical thinning and prescribed fire treatment outside of recommended wilderness areas. A moderate amount of wood products, 9,000 to 12,000 cords of fuelwood, would be available for public use. Under alternative B, there would be limited need for temporary roads to access mechanical vegetation treatment on 2,000 to 5,000 acres each year and to provide access for fuelwood and other product removal.

In addition to the 230 miles of system road annual maintenance, one to three mile of system roads, unauthorized routes, or both would be relocated, improved, or decommissioned annually

System roads used for mechanical vegetation treatment and product removal would be maintained and reconstructed where needed with best management practices that would improve water quality and soil productivity to sustain ecological resilience and improve access for administration and recreation use while benefiting local economic resilience. These benefits to the national forest road system and resources under alternative B would be less than alternative C but greater than alternatives A and D.

Facilities

Under alternative B, there would be a slight decrease of risk to facilities due to the potential reduction of wildfire severity. Wildfire risk to facilities would be reduced through 2,000 to 5,000 acres of mechanical vegetation treatment each year. Fire risk to facilities would also be reduced with prescribed burning and wildfire management. Under alternative B, 4,200 to 12,000 acres would be prescribe burned and 2,200 to 5,500 acres would be managed with wildfire each year.

Annual facilities work is planned to maintain 65 percent of high risk and necessary conditions for accessibility needs, safety hazards, environmental compliance, water systems, and other condition needs to standards.

Environmental Consequences – Alternative C

National Forest Road System

Alternative C emphasizes restoration and partnerships by increasing the intensity of restoration treatments across multiple resources in proposed larger, broad-based restoration and conservation management areas. Desired vegetation conditions would be maintained with mechanical thinning and more areas planned for prescribed fire than under alternatives B or D. There would be a greater need for equipment access for mechanical vegetation treatment and for hauling products than under alternatives A, B, and D. Alternative C emphasis is to restore ecological resiliency with mechanical vegetation treatments to lower insect and disease mortality risk in areas near the national forest boundary, private inholdings, developed recreation sites, roads, and other developed areas. There could be a need for temporary roads to access thinning areas and to provide access for fuelwood and other product removal, although most vegetation treatment would in areas where the national forest road system is in place.

Under alternative C, 12,000 to 15,000 cords of fuelwood would be provided for public use. System roads would be maintained and reconstructed to access mechanical vegetation treatment on 2,800 to 7,000 acres each year.

In addition to the 230 miles of system road annual maintenance, road maintenance and improvements would be done to access mechanical treatment areas, three to five mile of system roads, unauthorized routes, or both would be relocated, improved, or decommissioned annually. Potential impact of system road decommissioning would be analyzed at the project level. Additional road improvement work would be needed for vegetation treatment access.

Alternative C road improvement activities (needed for mechanical vegetation treatment access and recurrent road work) with best management practices would reduce sediment transport from roads, improve conditions for water and soil to sustain ecological resilience and improve access for administration and recreation use while benefiting the local economy.

Additional road maintenance, reconstruction, realignment, relocation and other improvements needed for mechanical vegetation treatments, with associated resource benefits, is expected to be greater under alternative C than under alternatives A, B, and D.

Facilities

Alternative C emphasis is to restore ecological resiliency and lower insect and disease mortality risk in areas near the Cibola National Forest boundary, inholdings, developed recreation sites, roads, and other developed areas (wildland-urban interface). Desired vegetation conditions would be maintained with increased mechanical thinning and more prescribed fire than under alternatives A, B, or D. District offices, crew quarters, warehouses, barns, residential housing, storage facilities, and water systems are predominantly located within these wildland-urban interface areas.

Wildfire risk to facilities would be reduced with mechanical vegetation and fuel treatments and prescribed fire. Under alternative C, 2,800 to 7,000 acres would be mechanically treated annually. Under alternative C, 4,900 to 14,000 acres would be treated with prescribed fire and 2,400 to 6,000 acres would be managed with wildfire each year.

Annual facilities work is planned to maintain 65 percent of high risk and necessary conditions for accessibility needs, safety hazards, environmental compliance, water systems, and other condition needs to standards.

Facilities protection and maintenance would provide safe access for public and administrative use of developed sites and support community and economic resilience through contracting deferred maintenance work. Alternative C would result in the greatest reduction in risk to facilities among all alternatives.

Environmental Consequences – Alternative D

National Forest Road System

With emphasis on backcountry, primitive recreation, and recommended wilderness, alternative D would have less need and use of the national forest road system for product removal than alternatives A, B, and C. Alternative D would have the same number of acres of mechanical vegetation treatment as alternative A outside recommended wilderness areas. There would be less need for road reconstruction, maintenance, and improvements in conjunction with the decreased equipment access needed for mechanical treatments, fuelwood, and commercial product removal than under alternative C.

Two hundred and thirty miles of annual system road maintenance would take place under alternative D. In addition to the 230 miles of annual system road maintenance, under alternative D, up to three miles of system roads would be reconstructed relocated, realigned or improved; system roads that are no longer needed or unauthorized roads would be decommissioned annually, or both. Potential impact of road decommissioning would be considered at project level planning.

Under alternative D, 9,000 to 12,000 cords of fuelwood would be provided for public use. System roads would be maintained and reconstructed or improved to access mechanical vegetation treatment on 2,000 to 5,000 acres each year. Road improvement work with best management practices would benefit water quality, soil productivity, and conditions for other resources. Under alternative D, there would not be a need for temporary roads, no roads would be constructed.

Alternative D road improvement activities, similar to alternatives A and B, would reduce sediment transport from roads, improve conditions for water and soil to sustain ecological resilience, and improve access for administration and recreation use while benefiting the local economy. Road-related resource benefits under alternative D would be less than benefits under alternative C.

Facilities

Alternative D emphasizes backcountry and primitive recreation with less mechanical vegetation treatment in developed areas. This alternative accepts higher risk across larger areas, such as allowing for managing naturally ignited wildfires.

Wildfire risk to facilities would be the same as alternative B with the same objective levels for mechanical vegetation, fuel treatments, and prescribed and managed wildfire.

Annual facilities work is planned to maintain 65 percent of high risk and necessary conditions for accessibility needs, safety hazards, environmental compliance, water systems, and other condition needs to standards.

Under alternative D, there would be the same number of acres of mechanical vegetation treatment as alternatives A and B

Cumulative Environmental Consequences

The analysis area for cumulative effects for the National Forest road system and facilities are adjoining public lands, counties encompassing the Cibola National Forest, New Mexico State highways, and other roads that access and traverse the Cibola. The temporal scope for cumulative effects is the life of the plan (15 years). Cumulative effects would be similar for all alternatives.

Any future landscape-scale restoration projects designed to reduce the threat of high-intensity, potentially destructive fires could increase road needs and use. Increased traffic and truck and heavy equipment use for vegetation treatment and product removal would require road improvements to safely implement vegetation treatments.

Commercial traffic (product hauling) can be expected to fluctuate to some degree, relative to vegetation management activities. Market conditions and other external factors can influence treatment activity levels. Commercial traffic conditions are usually limited to relatively small geographic or project operations areas for short periods. Commercial road use would be higher under alternative C, with more area planned for mechanical vegetation treatments than under alternatives A, B, and D.

The New Mexico Department of Transportation statewide transportation improvement plan, FFY 2018 – 2023, in the vicinity of the Cibola National Forest, indicates no major activities that are expected to increase or decrease access needs on the Cibola (New Mexico Department of Transportation 2017). New Mexico Department of Transportation future road improvements could facilitate an increase in forest visitors if driving time to the Cibola from urban areas is reduced. A potential increase of Cibola National Forest visitors using the national forest road system could result in more frequent road maintenance needs. Under all alternatives, road maintenance and improvements with best management practices would facilitate the expected increase in Cibola National Forest visitors.

Under all alternatives, additional road maintenance, reconstruction, relocation, realignment, other improvements, or decommissioning associated with mechanical vegetation treatment would provide safe access to National Forest System land. Road improvements would reduce sediment transport; improve water and soil quality to support ecological resilience; and support economics through timber harvest, wood cutting, range, minerals and other forest product uses with beneficial impacts on local economies that benefit economic resilience. Improved access would provide added opportunities for recreation to benefit sustainable recreation.

Future forest visitation, administrative use, fire potential, and aging systems would cumulatively increase the risk and maintenance needs to Cibola National Forest facilities. All alternatives would reduce the risk from uncharacteristic wildfire and reduce potential deterioration from deferred maintenance and the need for replacement.

Effects of vegetation treatments, fuel and fire risk reduction and addressing facilities deferred maintenance, would provide safe public and administrative access, and support community use for public information and other needs. Facilities protection and maintenance would support local economic resilience, through contracting deferred maintenance work.

Designated Areas

Affected Environment

Designated special areas contribute to social sustainability by connecting people to their natural and cultural heritage and providing economic benefits to surrounding communities. They promote the preservation of cultural traditions including historical features that contribute to social wellbeing through education and provide recreational opportunities. Economic sustainability is supported by increased employment opportunities and supporting small businesses. Designated areas contribute to ecological sustainability as well, by preserving intact natural systems and their individual components. Some designated areas may contribute to national defense, energy, and scientific research goals.

Designated areas are formally designated either by statute or by administrative action. Congressionally designated areas are established through a formal act of Congress, such as wilderness areas, wild and scenic rivers and national recreation areas. Administratively designated areas include research natural areas, and special interest areas such as historic areas, geologic areas, scenic areas, and botanical areas. These areas may be proposed in land management plans but are established through a separate process. Special interest areas exist for the protection and public enjoyment of areas of special characteristics.

Once areas have been designated, by either Congress or Federal agencies, the designation does not usually change. Areas recommended or proposed in land management plans may change. Designated areas (see map packet) within the Cibola or immediate area of influence include:

- Langmuir Site for Atmospheric Research and Magdalena Ridge Observatory
- Bernalillo Watershed Research Natural Area
- Department of Defense (DOD) Kirtland Air Force Base and Department of Energy (DOE) Withdrawal Area
- Sandia Cave National Historic Landmark
- T'uf Shur Bien Preservation Trust Area
- Continental Divide National Scenic Trail
- 13 inventoried roadless areas
- 6 nationally or State-designated scenic byways
- 4 designated wilderness areas

As cited in the Volume II Socioeconomic Assessment for the Cibola National Forest Mountain Ranger Districts, USDA 2015: "The Federal Caves Resources Protection Act of 1988, directs the Secretary of Agriculture to prepare and maintain a list of significant caves. The criteria for listing are in 36 CFR part 290.3(c). The Forest Service policy is to identify and manage significant caves. Cave resources include wildlife habitat, most notably for bat populations, such as pale Townsend's big-eared bat. Twenty significant caves have been listed for the plan area. Caves must meet at least one of a number of criteria of significance. All of the plan area caves have to meet the criterion of cultural significance. The listing is omitted here, as information associated with caves, including common names and locations, is sensitive with regard to cultural and heritage resources, sensitive bat hibernacula (habitat), fragility of the sites, and safety concerns." The location of nineteen of the significant caves identified within the Cibola Assessment is omitted due to the aforementioned sensitivity and safety concerns; the Sandia Cave National Historic Landmark is the exception due to its status as a national historic landmark.

This section also includes areas that contain special, exceptional, or unique values providing important ecosystem services. Some of these areas meet the criteria to be considered special places and become designated areas administratively by authorities or through Congress such as recommended wilderness areas and eligible wild and scenic rivers.

Existing Conditions and Trends

Designated Wilderness

Designated wilderness is governed by the terms of the Wilderness Act and other specific legislation, directing management activities within wilderness and reducing human impacts and influences to desired levels. These regulations are designed to protect the qualities of wilderness character. Effects to wilderness are measured by how any particular project or planning effort may impact the wilderness character of a wilderness area. Project proposals within these areas are evaluated for compliance with wilderness values and maintaining the respective five qualities of wilderness character. Commercial services in wilderness is controlled by special use permits and the operation plans that are required under the special use permits.

The four wildernesses on the Cibola National Forest were established under either the Endangered American Wilderness Act of 1978 (16 USC section 1132), or the New Mexico Wilderness Act of 1980 (16 USC section 1132 et seq.). Lands designated under the Endangered American Wilderness Act of 1978 were found to possess outstanding natural characteristics and met the statutory criteria as established in the Wilderness Act of 1964. Because these lands were subjected to pressures of population growth and development, Congress found it in the national interest to designate these areas to promote and perpetuate the wilderness character for future generations. The New Mexico Wilderness Act was enacted to promote and preserve the wilderness characteristics of the land, protect watersheds and wildlife habitat, and promote scientific research and primitive recreation. This act established or approved additions for 12 wilderness areas in New Mexico.

The Cibola has 138,378 acres of designated wilderness areas on three districts (see table 52 and the alternative maps in the map packet):

- Sandia Ranger District: Sandia Mountain Wilderness
- Mountainair Ranger District: Manzano Mountain Wilderness
- Magdalena Ranger District: Apache Kid Wilderness and Withington Wilderness

Table 52. Designated wilderness acreage

Resource Element	Total Acres (Acres within National Forest)	Percent of Forest
Sandia Mountain	37,877	2
Apache Kid	44,626	3
Withington	19,000	1
Manzano Mountain	36,875	2
Total	138,378	9

Cibola GIS: Acres are approximate

Detailed descriptions of the wilderness areas can be found in the Cibola National Forest assessment report, volume 2 (USDA Forest Service 2015b).

Congressionally designated wilderness areas are often associated with a primitive type of recreation opportunity, but the primitive recreation opportunity spectrum class is not synonymous with designated wilderness. On the Cibola National Forest, the Sandia Mountain, Manzano Mountain, and Withington Wilderness areas are inventoried and mapped as the semi-primitive nonmotorized 1985 recreation opportunity spectrum class under the 1985 plan direction. Part of the Apache Kid Wilderness (8,965 acres) is classified as primitive, and the remainder is classified as semi-primitive nonmotorized under the 1985 plan direction.

Under the 1985 plan, the four designated wilderness areas were also inventoried and mapped using the wilderness opportunity spectrum. The wilderness opportunity spectrum provides a way to describe the variations in the degree of isolation from the sounds and influence of people, and the amount of recreation visitor use in designated wilderness area (Cibola National Forest assessment report, volume 2). The wilderness opportunity spectrum framework is confusing, specifically regarding the group size restrictions and is not widely used and difficult to manage. Therefore, replacing the wilderness opportunity spectrum classifications on the Cibola was a need for change, and the wilderness areas have been reviewed in terms of the recreation opportunity spectrum.

National visitor use monitoring data shows an increase in designated wilderness national forest visits on the Cibola from 84,000 in 2006 to 278,000 in 2011. The most recent data collected from the 2016 round shows a decrease in wilderness national forest visits from 278,000 to 161,000. Wilderness values and resources, naturalness, wildness and solitude may still be affected by recreation use. Without appropriate management, the quality and values of wilderness may be compromised. Table 53 displays designated wilderness visits.

Table 53. Cibola National Forest designated wilderness forest visits

Year	Wilderness visits
2006	84,000
2011	278,000
2016	161,000

Approximately 274 miles of recreational trails are in wilderness areas. Trail use continues to increase, resulting in ongoing challenges in the maintenance, construction, and reconstruction of trails. Additionally, unauthorized routes (created both by motorized and nonmotorized users) are on the rise. Over time, implementation of travel management decisions should reduce the amount of motorized travel off the designated system, but travel management only addresses motorized uses. It does not address nonmotorized uses (such as mountain bikes and horses) that may travel off the designated system and create unauthorized routes.

Rise in trail users and motorized encroachments can produce heavy scars to the land compromising the goals of the Wilderness Act. The act directs agencies to protect and manage wilderness "so as to preserve its natural conditions," ensuring that wilderness "generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable". Poorly located and constructed trails can erode soils and affect soils characteristics which can lead to degrading vegetative community (Therrell et al. 2006). Also, motorized encroachments violate the Wilderness Act as well as impact wilderness experience by diminishing the quality of opportunity for solitude.

Current possible trends affecting designated wilderness areas include heavily used zones adjacent to and within wilderness due to proximity to urban areas possibly impacting wilderness character. Change in public preference of outdoor activities and new emerging activities modify wilderness areas. Geocaching has emerged in the past decade requiring management direction to protect wilderness resources.

Climate change might affect the willingness of individuals to participate in recreation activities or affect recreation resource availability and quality. Effects from climate change may lead to less visitation by hikers due to increased temperatures, more uncharacteristic wildfire risk, and closure risk from longer dry and hot seasons. In the 2010 Resources Planning Act assessment (USDA Forest Service 2012d), the most pronounced effects were associated with projected increases in average temperature and decreases in precipitation (Bowker et al. 2012). Greater temperatures can increase the risk of wildfire and uncharacteristically-severe wildfire which could have negative and unpredictable effects on trails and trail users. Overall, trail users respond negatively and show decreased short-term return rates to areas that have experienced uncharacteristic wildfire, such as the Schultz Fire and the Slide Fire (Hesseln et al. 2003; Starbuck et al. 2006).

In New Mexico, Hesseln and others (2003) found visitation to areas recovering from crown fires, by both hikers and mountain bikers, decreased through time. Similarly, Starbuck and others (2006) showed unrestored areas in the five national forests of New Mexico that experienced uncharacteristic fire were unappealing to bikers and hikers. According to the study's model, decreases in post-fire recreational visitation by hikers and bikers resulted in estimated losses of $51.65 million in output, $23.31 million in earnings, and a loss of 1,240 jobs.

Fires can also severely damaged trails, and subsequent flooding can be more destructive and cause more substantial damage than the fire itself. Large debris flows caused by rainfall on the denuded slopes can destroy major sections of trail or render them unpassable and invisible due to large boulders and tree trunks transported by the floodwaters and debris flows. Much of this flood damage occurs on trails that cross steep slopes or drainages. Trails can be closed for long periods of time before rehabilitation of the trails allow to reopen them. The economic cost and effort to reopen these trails is immense.

As stated in the document "Wilderness and Climate Change" (USDA Forest Service 2011d), climate change fundamentally compromises the degree to which wilderness functions as a refuge from effects of expanding civilization. It also exacerbates other ecological problems such as:

- amplifying the adverse effects of fragmentation by increasing the need for some species to migrate;
- increasing invasions by undesirable species that are better adapted to disturbed areas and climatic shifts;
- more expansive outbreaks of insects and disease; and
- enhanced risk of catastrophic wildfire, leading to attempted fire suppression, ultimately exacerbating fire risk, insect and disease problems, and other attributes of unhealthy forests.

However, wilderness stewardship can assist with adapting to the changes caused by climate change in ways: understanding ecological systems, sustaining biodiversity, connecting landscapes, providing ecosystem services, and fostering human-nature relationship. These findings can be transposed to most other designated areas.

Permitted grazing remains an existing use in all designated wilderness areas where it was allowed at the time of designation by Congress. At the time of designation, there was no permitted grazing in the Sandia Mountain Wilderness. However, the Manzano Wilderness, Withington Wilderness, and Apache Kid Wilderness all had active grazing allotments at the time of designation, and grazing has continued. There are currently no vacant allotments in these three wilderness areas, and no allotments have been closed to grazing since wilderness designation. Permitted grazing has continued after designation under the requirements of the 1985 plan, applicable laws, and congressional grazing guidelines. Consistent with the grazing guidelines, motorized access has continued where necessary for maintenance of range improvements. Grazing is expected to continue in these wilderness areas.

Inventoried Roadless Areas

In 1970, Forest Service personnel studied all administratively designated primitive areas and inventoried all essentially roadless areas greater than 5,000 acres in the National Forest System. This national study was known as roadless area review and evaluation (RARE). Due to a legal challenge, RARE was halted in 1972. In 1977, the Forest Service began another roadless area review, RARE II. In 1978, the Cibola National Forest completed their RARE II inventory of unroaded areas and identified areas that met the criteria for further consideration as wilderness.

Four of those areas are now designated: Sandia Mountain, Manzano Mountain, Apache Kid, and Withington. The remaining areas were found to have characteristics benefited by multiple use management and were designated as inventoried roadless areas (USDA Forest Service 1979a). In the 1979 final environmental impact statement for RARE II, none of the existing inventoried roadless areas on the Mt. Taylor Ranger District or on the Datil, Bear, or Magdalena Mountains on the Magdalena District were recommended for inclusion in the wilderness preservation system. Congress did designate portions of the inventoried roadless areas recommended in the Magdalena Ranger District, the San Mateo Mountains, which became the current Apache Kid and Withington Wilderness areas.

Official inventoried roadless area boundaries were established in the final environmental impact statement of the 2000 Forest Service Roadless Area Conservation Rule, and plan revision does not include reconsideration of these boundaries. Maps within the map packet depict the thirteen Cibola inventoried roadless areas, and table 54 and table 55 present location and size information. No inventoried roadless areas occur on the Sandia and Mountainair Ranger Districts. Regarding public lands management, current regulations have restrictions prohibiting future road construction or reconstruction. However, motorized trails are not prohibited, but are constrained by the motor vehicle use map for the ranger district. Potentially suitable wilderness areas have been inventoried and evaluated using criteria consistent with the 2012 Planning Rule; all inventoried roadless areas have been considered in that inventory and evaluation (see appendix C, wilderness recommendation process).

Table 54. Inventoried roadless areas on the Mt. Taylor Ranger District

Name	Acreage	Location
Mt. Taylor	6,355	San Mateo Mountains, Mt. Taylor Ranger District, 16 miles east-northeast of Grants
Ranger Cabin	6,124	San Mateo Mountains, Mt. Taylor Ranger District, 25 miles northeast of Grants
Cerro Alesna	6,184	San Mateo Mountains, Mt. Taylor Ranger District, 28 miles northeast of Grants
Guadalupe	13,619	San Mateo Mountains, Mt. Taylor Ranger District, 41 miles northeast of Grants
Ignacio Chavez Contiguous	993	San Mateo Mountains, Mt. Taylor Ranger District, adjacent to Bureau of Land Management wilderness study areas, 25 miles west of San Ysidro

Table 55. Inventoried roadless areas on the Magdalena Ranger District

Name	Acreage	Location
Madre Mountain	19,839	Datil Mountains, Magdalena Ranger District, 14 miles north of Datil
Datil	13,957	Datil Mountains, Magdalena Ranger District, 2 miles north of Datil
Scott Mesa	39,515	Bear Mountains, Magdalena Ranger District, 12 miles north of Magdalena
Goat Spring	5,755	Bear Mountains, Magdalena Ranger District, 5 miles north of Magdalena
Ryan Hill	34,200	Magdalena Mountains, Magdalena Ranger District, 12 miles southeast of Magdalena
White Cap	8,036	Adjacent to Withington Wilderness, San Mateo Mountains, Magdalena Ranger District
Apache Kid Contiguous	67,542	Adjacent to Apache Kid Wilderness, San Mateo Mountains, 30 miles south of Magdalena, Magdalena Ranger District
San Jose	16,950	Adjacent to Apache Kid Wilderness in San Mateo Mountains, 43 miles south of Magdalena, Magdalena Ranger District

Inventoried roadless areas will continue to benefit dispersed recreation opportunities such as hiking, hunting, fishing, camping, wildlife watching, and biking. Current inventoried roadless area management supports biodiversity; the long-term survival of at-risk species; protection against rapid spread of noxious weeds; and reference areas for study and research.

Research Natural Areas

Research natural areas include relatively undisturbed areas of the national forest that form a long-term network of ecological reserves designated for research, education, and the maintenance of biodiversity. This designation applies to both established and proposed research natural areas (USDA Forest Service 2019).

Research natural areas are selected to preserve a spectrum of relatively pristine areas that represent a wide range of natural variability within important natural ecosystems and environments, and areas that have unique characteristics of scientific importance (USDA Forest Service 2019). The purposes of research natural areas are (1) to preserve examples of all significant natural ecosystems for comparison with those influenced by man, (2) to provide educational and research areas for ecological and environmental studies, and (3) to preserve gene pools of typical and endangered plants and animals.

Research, study, observation, monitoring, and educational activities that are nondestructive and nonmanipulative are generally allowed within research natural areas. While research natural areas are generally unsuitable for livestock grazing, some incidental use by livestock could occur within these areas as administrative boundaries are typically not fenced.

When the 1985 plan was written, there were no designated research natural areas on the national forest. At the time, it was considered that options for designating research natural areas would diminish as the population increased, and demands for recreation, timber, and fuelwood would increase accordingly.

To preserve specific vegetation types for future study, the 1985 plan identified suitable candidate areas to study for possible research natural area inclusion on two mountain districts. The proposed areas are:

- Mt. Taylor Ranger District: 910 acres in Little Water Canyon. The **Little Water Canyon** survey and documentation was incomplete and was not officially designated. It has unique botanical diversity, including an underrepresented blue spruce/red-osier dogwood plan association. For these reasons, Little Water Canyon was recommended as a research natural area in the 1985 plan. Under the Cibola draft land management plan, it is being proposed as a site-specific special management area (see Special Management Areas).
- Sandia Ranger District: 990 acres in the Bernalillo watershed. The **Bernalillo Watershed Research Natural Area** was ultimately designated and comprises 299 acres of juniper grassland and 731 acres of semi-desert grassland. Over time, the Sandia Ranger District personnel have found it increasingly difficult to manage and protect the Bernalillo Watershed Research Natural Area due to the location; that is, the distance from the district office and the rapid residential development in and around Placitas. User-defined trails and unauthorized parking areas have multiplied in the Bernalillo Watershed Research Natural Area. Sandia Ranger District personnel have taken a proactive approach in mapping and signing system trails to mitigate this evolving land use conflict between differing recreational uses and research interests, while preserving the research value of the research natural area (USDA Forest Service 2015b).

Recommended Wilderness Areas

There are currently no areas of recommended wilderness under the 1985 plan on the Cibola. Cibola National Forest personnel completed the required 2012 Planning Rule process of revising the land management plan for the four mountain ranger districts: Mount Taylor, Magdalena, Mountainair, and Sandia. Part of the revision process includes identifying and evaluating lands that may be suitable for inclusion in the National Wilderness Preservation System and determining whether to recommend to the Chief of the Forest Service any such lands for wilderness designation. A description of this process can be found in the 2012 Forest Service Planning Rule and chapter 70 of the Forest Service Land Management Planning Handbook 1909.12. See appendix C for further detail on the wilderness recommendation process conducted for the Cibola plan revision effort.

Once the land management plan is finalized, the final environmental impact statement is released, and a record of decision is signed, the Cibola forest supervisor may recommend suitable lands for National Wilderness Preservation System designation to the Chief of the Forest Service, if the record of decision contains suitable lands. Such recommendation may then be forwarded to the Secretary of Agriculture, and ultimately to Congress, for its consideration and possible designation. Congress has reserved the authority to make final decisions on wilderness designation. Until potential designation by Congress, the recommended wilderness areas proposed by each alternative are not designated areas, they are management areas, with specific plan direction pertaining to their management (see chapter 3, draft land management plan).

Concerns with recommending lands for wilderness designation include less flexibility to manage the land and resources and in particular to loss of motorized access and motorized recreation opportunities. Wilderness Connect (www.wilderness.net) discusses the myth about wilderness—that it imposes economic costs on local communities. It explains that this idea is often embodied in the "jobs versus environment" argument, suggesting there is an inherent tradeoff between economic prosperity and strong environmental protection. Some opponents of wilderness designation claim it locks up acreage that could generate revenue through the extraction of timber, minerals, and other resources and through the motorized recreation prohibited in most wildernesses.

Land use designation such as designated and recommended wilderness can impact the ability of certain activities to be accomplished on the land, directly or indirectly affecting the local economy. However, there are economic benefits of recreation, which in many cases are protected through land use designation. For instance, the socioeconomic analysis for the proposed alternatives (see “Socioeconomic” section) indicated recreation contributes the most to employment in the Cibola’s regional economy and the second highest in terms of annual labor income contributions.

In this analysis, the alternatives differ in the total areas recommended for preliminary administratively recommended additions to the National Wilderness Preservation System and areas not recommended for wilderness.

Eligible Wild and Scenic Rivers

As part of the land management plan revision process, the Forest Service shall conduct a comprehensive inventory and evaluation to determine which rivers on the Cibola are eligible for inclusion in the National Wild and Scenic Rivers System (Forest Service Handbook 1909.12, chapter 80 and 36 CFR section 219.7(c)(2)(vi)).

In the early 2000s, Cibola National Forest personnel completed an eligibility study of potential wild and scenic rivers (number of rivers assessed was approximately 365, according to the accompanying environmental assessment) and released an environmental assessment. Cibola National Forest personnel amended the 1985 plan in 2002 based on this information (see amendment 10 of the 1985 plan).

Table 56 shows the rivers which meet eligibility criteria for further study applying to the interim management in amendment 10 (USDA Forest Service 1985a). There are 40 total miles of wild and scenic rivers.

Table 56. Rivers studied for national wild and scenic river system and found eligible in 2002

Ranger District	River	Miles	Preliminary Classification
Mt. Taylor	Agua Remora	1.5	Wild
Mt. Taylor	Little Water Canyon (Zuni side)	2.3	Wild
Mt. Taylor	Lobo Creek	9.1	Recreation
Magdalena	West Red Canyon (headwaters)	11.7	Recreation
Mountainair	Tajique Creek	8.3	Recreation
Sandia	Lower Las Huertas Creek	7.1	Recreation

In summary, the previous eligibility study was done using a different set of criteria and different region of comparison with insufficient documentation. As a result, Cibola National Forest personnel conducted an eligibility study in the current land management plan revision efforts. This process is outlined in appendix D, wild and scenic river eligibility process. When a final plan is selected, the responsible official will decide regarding which of the rivers are eligible for inclusion in the National Wild and Scenic River System.

Eligible wild and scenic rivers are not designated areas, but are eligible areas that may (upon further environmental analysis), become designated wild and scenic rivers if Congress so designates the areas. Until potential designation by Congress, the eligible wild and scenic river reaches identified during this plan revision effort are not designated areas, they are management areas, with specific plan direction pertaining to their management (see chapter 3, draft land management plan).

Table 57 displays the results from the updated analysis of the national wild and scenic river eligibility process.

Table 57. Rivers studied for national wild and scenic river system and found eligible in 2017

Ranger District	River	Miles	Outstandingly Remarkable Value(s)	Classification
Mt. Taylor	Agua Remora	1.9	Fish population	Wild and scenic
Mt. Taylor	Little Water Canyon	2.0	Botanical	Wild and scenic
Mt. Taylor	Water Canyon #1	2.2	Geology and scenery	Wild
Mt. Taylor	Rinconada	2.7	Wildlife population and habitat	Wild
Magdalena	West Red Canyon	7.7	Historic and cultural	Recreational
Mountainair	Tajique Creek	3.9	Botanical, scenery, and recreation	Recreational
Sandia	Las Huertas Creek	7.1	Historic and cultural, and scenery	Recreational

The latest wild and scenic river eligibility study resulted in less mileage of eligible stream totaling 27.5 miles compared to 40 miles in 2002. Furthermore, Lobo Creek and Lower Las Huertas Creek were removed from the 2002 study and Rinconada, Water Canyon #1 and Las Huertas Creeks were added in 2017. See appendix D for further detail on the wild and scenic river evaluation process.

Demand for river designation is expressed primarily through public comment and responses to agency proposals. The degree to which the public favors designation indicates the demand for a wide range of uses, activities, and resource qualities associated with river management. Rivers and stream corridors accommodate a lot of different uses such as picnicking, fishing, day hiking and walking for pleasure, primitive camping, boating (canoeing, kayaking, rafting, tubing), swimming, and nature study. Although demand is closely related to the current population and the projected growth of the local area, designation would likely produce increased levels of recreation use in designated and potential corridors.

Scenic Byways

Six national scenic byways are within the Cibola National Forest area of influence. The National Scenic Byways Program was administered by the U.S. Department of Transportation, Federal Highway Administration until 2012 when the program was terminated. It was established to help recognize, preserve, and enhance selected roads throughout the Nation. In 1995, the Secretary of Transportation recognized these designated roads based on one or more intrinsic qualities: archaeological, cultural, historic, natural, recreational, or scenic. As of April 2019, there are legislative efforts to reopen the program. There are also two scenic byways with New Mexico State designation within the planning area (Salt Missions Trail and Trail of the Ancients). Since these two scenic byways are state designations outside of the Cibola's jurisdiction, they are not addressed in the draft land management plan nor in this environmental analysis.

Detailed descriptions of the scenic byways can be found in the Cibola National Forest assessment report, volume 2 (USDA Forest Service 2015b).

Listed below are the national scenic byways within the Cibola administrative boundary:

- Route 66 National Scenic Byway is sometimes called "The Mother Road." This byway also carries a historic state designation.
- El Camino Real National Scenic Byway
- Turquoise Trail National Scenic Byway (including the Sandia Crest Scenic and Historic Byway)

Scenic byways are some of the most visited areas on national forests. The 2016 national visitor use monitoring survey data indicates 23.6 percent of the national forest visits on the Cibola used scenic byways, making it the second most used special facility or area on the Cibola, after visitor centers or museums. Additionally, this survey data shows driving for pleasure represents 13.5 percent of activity participation, making it the sixth most popular activity. While the activity participation for driving for pleasure has decreased from 2006 and 2011 national visitor use monitoring surveys, 20 percent and 18.6 percent respectively, it remains a popular activity ranking in the top six activities. Use of scenic byways should continue to be popular in the future.

National Trails System Trails

The National Trails System is the network of scenic, historic, and recreation trails created by the National Trails System Act of 1968. These trails provide for outdoor recreation needs; promote the enjoyment, appreciation, and preservation of open-air, outdoor areas and historic resources; and encourage public access and citizen involvement. Under the National Trails System Act, three categories of trails are identified to be part of the national trails system: recreation, scenic, and historic. The Cibola National Forest is home to the Continental Divide National Scenic Trail. The scenic category refers to trails that are extended trails, located to provide maximum outdoor recreation potential and the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas through which such trails may pass.

The Continental Divide National Scenic Trail is a designated hiking trail running 3,100 miles between Mexico and Canada. An approximately 45-mile segment was constructed on the Mt. Taylor Ranger District between 2007 and 2010. It runs from the Continental Divide Trailhead near Grants in an irregular, but generally northeasterly direction from the trailhead onto Bureau of Land Management land north of El Dado Mesa. It provides high-quality, scenic, primitive hiking, and horseback riding recreational experiences, while conserving natural, historic, and cultural resources along the Continental Divide. Trail users are responsible to bring their own water as there is no potable water along the trail. Camping on state land is allowed only with a permit and is prohibited on private lands (USDI Bureau of Land Management 2019). Mountain biking also occurs on sections of the trail.

As defined in its comprehensive plan, the nature and purposes of the Continental Divide National Scenic Trail are to provide for high-quality scenic, primitive hiking and horseback riding opportunities and to conserve natural, historic, and cultural resources along the trail corridor. The trail is temporarily located along state and county highways over an approximately 52-mile section of trail in the Mt. Taylor and Magdalena Ranger Districts. This alignment is not consistent with a primitive hiking and horseback riding experience and presents a safety issue for those hiking on the road.

Bureau of Land Management and Forest Service personnel have been working cooperatively to identify a permanent, high-quality route for the trail off of roads. Bureau of Land Management personnel are focusing part of the relocation on an area on Alamocita Creek immediately north of the Magdalena Ranger District. The Zuni Mountains on the Mt. Taylor Ranger District remain a viable option for extension of the Continental Divide National Scenic Trail.

Designated national system trails benefit from the prestige and increased visibility. Over the past few years, there has been a steady increase of 3,000 milers on the Continental Divide National Scenic Trail (Continental Divide Trail Coalition list of 300 milers, http://continentaldividetrail.org/cdtc-official-list-of-cdt-thru-hikers/). This correlates with a general increase of hiking trail use nationwide. The Continental Divide National Scenic Trail can anticipate a continued increase of use for the years to come. The trail is expected to grow in popularity and use in the coming decades.

Other Designated Areas

Sandia Cave National Historic Landmark (formally known as Sandia Man Cave) is a horizontal solution cavity located high on the east side of Las Huertas Canyon in the northern Sandia Mountains, just east of the city of Albuquerque, New Mexico. The cave was designated a national historic landmark in 1961. It is also listed on the National and New Mexico State Register of Historic Places and is a traditional cultural property. The cave displays evidence of sporadic but continuous use for the past 10,000 years and continues to be a place of cultural and spiritual significant to several Pueblo communities in New Mexico.

It has also played an important role in the history of archaeological thought about the Paleoindian period and southwestern archaeology. Because it is a cave with historic, recreational, educational, geological, and biological value in an area of very few caves, the cave has become one of the most popular sites for recreationists and school and university environmental education groups on the Cibola. This site is expected to remain a highlight of the Cibola, attracting diverse and numerous visitors and researchers.

The T'uf Shur Bien Preservation Trust Area is a congressionally designated area of approximately 9,890 acres to recognize and protect in perpetuity the Sandia Pueblo's rights and interests in and to the area, preserve in perpetuity the wilderness and national forest character of the area, and to respect and assure in perpetuity the public's longstanding use and enjoyment of the area (discussed in chapter 2 of this volume). It is adjacent to and overlaps the northwestern section of Sandia Mountain Wilderness. The T'uf Shur Bien Preservation Trust Area Act (Act; 16 USC section 539m-2) established the trust area within the Cibola National Forest. The area continues to be administered as part of the National Forest System consistent with the provisions of the act affecting management of the area. For further detail on management directions as is specified in the aforementioned act, refer to the "T'uf Shur Bien Preservation Trust Area" section of the draft plan (chapter 3, management areas).

Over the years, the City of Albuquerque has grown in size and population and now has reaches the edge of the recreation areas. Easy access to the recreation areas has made it possible for many people to enjoy the facilities; however, it also subjects these areas to heavy vandalism, gangs, and other undesirable activity. The Cibola is exploring partnership opportunities to help address the maintenance and management challenges at this area.

Langmuir Site for Atmospheric Research and Magdalena Ridge Observatory (Langmuir Research Site): Title II of the New Mexico Wilderness Act established the Langmuir Research Site on Magdalena Ranger District in 1980, to encourage scientific research into atmospheric processes and astronomical phenomena, and to preserve conditions necessary for that research. The principle research facility operates under a special use permit on about 1,000 acres. In April and May of 2012, a new special use permit was signed to continue scientific operations at the lab and associated Magdalena Ridge Observatory and is valid until December 31, 2031.

The area is primarily managed to preserve conditions necessary to meet the research needs of the Langmuir Lab. Land management emphasis is on dispersed recreation and wildlife habitat for federally listed and state-listed species, with lesser emphasis on timber management and providing firewood for personal use.

It is expected a continued and perhaps expanding interest in scientific research will occur.

Department of Defense Kirtland Airforce Base and Department of Energy Withdrawal Area: On the Sandia Ranger District, a 19,749-acre military withdrawal area is jointly administered by U.S. Forest Service, the U.S. Air Force, and the Department of Energy. The area is closed to public entry and use, but management emphasis under 1985 plan direction is to improve wildlife habitat diversity and decrease the threat of escaped wildfire.

Trends

The following discussion of trends related to nature-based recreation is based on the "Federal Outdoor Recreation Trends: Effects on Economic Opportunities Report" (White et al. 2016):

> "The national trends for nature-based outdoor recreation, assuming a stable base of public lands, indicate an increasing population will decrease per-person opportunities for recreation across the United States. There has been a steady increase in nature-based outdoor recreation over the last decade. This trend is anticipated to continue in the next decade. The five outdoor recreation activities projected to have the highest percentage growth in total days of participation are developed ski, visiting interpretive sites, day hiking, birding, and equestrian activities. The five activities expected to grow the least are hunting, motorized snow activities, motorized off-road use, floating, and fishing."

Designated areas will continue to be an important land base for outdoor recreationists, as they provide most of the opportunities identified in the trends mentioned above—visiting interpretive sites, day hiking, birding, and equestrian activities. There will continue to be a struggle between balancing the protection of natural resources on designated lands and the pressure from increased recreation use in the years to come.

Environmental Consequences

This section evaluates and discloses the potential environmental consequences to designated areas. The environmental consequences analysis will consider how each alternative provides for designated areas. Criteria for evaluating the potential level of change to the designated areas are measured by acres of land or miles of rivers or trail corridor depending on the type of designated area. Additionally, a qualitative discussion of the potential effects to the designated area from management activities is included if appropriate. Impact indicators for designated areas include:

- acres of land for each designated area or miles for linear designated area
- each proposed alternative addresses the core themes of the Cibola land management plan revision and resolves significant issues identified by the public

Indicators

- Acres assigned to each designated area. This indicator reflects changes to land available for differing anticipated to each management activities associated with each alternative.
- Miles assigned to each linear designated area. This indicator reflects changes to land available for differing anticipated to each management activities associated with each alternative.

Assumptions Specific to Designated Areas

- All designated wilderness is managed according to the Wilderness Act, 36 CFR 293, applicable Forest Service manuals and handbooks, any wilderness management plans, and the land management plan.
- Under all alternatives, the wilderness stewardship performance is used to measure how well the Forest Service is meeting the primary responsibility under the Wilderness Act for management of designated wilderness to preserve the wilderness character.
- Visitor use information specific to each district is not available. The best available science for recreation visitation, the national visitor use monitoring information, is collected for the entire Cibola National Forest and is not aggregated to the district level.

- Additional management tools and metrics used to manage wilderness values include the Scenery Management System, the recreation opportunity spectrum, and trail classifications used for National Forest System trails.
- Land management plan revision does not directly affect visitation rates on the Cibola National Forest; however, new or altered management direction may indirectly influence the type of opportunities that are available to the public.
- Any area recommended for wilderness through the planning process is a preliminary administrative recommendation that would receive further review and possible modification by the Chief of the Forest Service, Secretary of Agriculture, and the President of the United States. Congress has reserved the authority to make final decisions on wilderness designation.

Environmental Consequences Common to All Alternatives

Eligible Wild and Scenic Rivers

There are no designated wild, scenic, or recreational rivers currently on the Cibola. As part of the land management plan revision process, a comprehensive inventory and evaluation of eligible wild and scenic rivers was conducted in 2016 (appendix D). The following eligible wild and scenic rivers are common to all alternatives as the 2016 wild and scenic river eligibility study replaced the previous study conducted under the 1985 plan.

- Mt. Taylor (8.8 miles): 1.9 miles, Little Water Canyon 2 miles, Water Canyon #1 2.2 miles, Rinconada 2.7 miles
- Magdalena: West Red canyon 7.7 miles
- Mountainair: Tajique Canyon 3.9 miles
- Sandia: Las Huertas Creek 3.8 miles

The wild and scenic river eligibility study performed under the existing 1985 plan (amendment #10, 2002) applied a different set of criteria and different region of comparison than was used going forward in the current 2016 eligibility study. Reevaluation of wild and scenic river eligibility resulted in 7 river segments totaling 24 miles, which is a reduction of 16 eligible stream miles from the 2001 eligibility study. The current evaluation removed inconsistencies in criteria and the region of comparison and aligned management direction with the intent of the Wild and Scenic Rivers Act.

All alternatives have plan components for eligible wild and scenic river segments to maintain the free flow and outstandingly remarkable values unless a determination of ineligibility or nonsuitability is made. A river determined through a suitability study to be not suitable shall no longer be considered eligible and interim protection measures will no longer apply. If an eligible river is determined to be suitable and is designated as a wild and scenic river, the designation would not affect existing water rights or the existing jurisdiction of States and the Federal government as determined by established laws. If eligible wild and scenic rivers are designated by Congress or until they are designated or no longer deemed eligible, it will provide a higher protection for safeguarding clean water; preventing activities that would significantly harm the river's character and benefits; generally prohibiting new dams or damaging water projects; and protecting land along the river with a quarter-mile protective buffer along the wild and scenic river flowing through publicly owned lands (American Rivers 2019).

Designation can also reduce the impacts of floods, preserve some important ecosystems, enable native plants and animals to thrive, preserve the cultures of communities who once lived by the river, provide exceptional recreation and wildlife viewing, and improve understanding of the evolution of the planet by preserving special rock and geologic formations. Furthermore, it boosts the local economy by generating income through the growth of recreation and tourism activities. It is noteworthy that there are no known studies comparing river use levels before and after wild and scenic river designation.

It is important to note the Little Water Canyon reach in the Mt. Taylor Ranger District is deemed eligible due to its botanical outstandingly remarkable values.

Environmental Consequences Common to Action Alternatives, B, C, and D

Alternatives B, C, D provide a framework for managing designated areas through desired conditions, standards, and guidelines. The standards and guidelines in the draft land management plan are almost the same for alternatives B, C, and D, with the exception of management area plan-specific language. These clarifications focus on addressing the needs for change and the core themes identified in the public process. They attempt to better deal with current and future issues related to the sustainable management of designated areas on the Cibola. The different alternatives emphasize at various degree the four core management themes while considering the greater landscape and the Cibola's ecological, social and economic role in that landscape.

Consequently, these alternatives support the public's current desires and connections to the land, address the conflicting issues, and integrate the need for long-term sustainability pertaining to designated areas.

Continental Divide National Scenic Trail

The three action alternatives define a 0.5 mile corridor on either side of the Continental Divide National Scenic Trail and defines management direction to better protect and preserve hikers experience as well as the natural resources affected by the use of this special area. The established corridor under the action alternatives is wider than the current route. The effects from the purpose of this designated trail and buffer to conserve the natural, historic, and cultural resources along the trail corridor are benefits to water resources located adjacent to the corridor (such as increased infiltration, water retention, improved water quality) and benefits to historic and cultural resources (such as site protection, avoidance or mitigation). Updated plan direction for the Continental Divide National Scenic Trail under the action alternatives also guides the Cibola in relocation off roads within the life of the plan as close to the geographic Continental Divide as possible. This would potentially result in effects of less user conflicts and would bring the trail closer to guidance for national policy and management of the Continental Divide National Scenic Trail. Updated plan direction under action alternatives also provides alignment with best available science for scenery management using the Scenery Management System. This would result in direct scenery guidance for the Continental Divide National Scenic Trail which meets the intent of the designation of the trail as a national scenic trail.

While this trail must comply with its comprehensive plan, allowable activities must align with the original intent for the trail's national designation and current management direction possibly limiting recreation, administrative and natural resources management activities that could occur under the no-action alternative.

Bernalillo Watershed Research Natural Area

Updated plan direction for the Bernalillo Watershed Research Natural Area contains similarities to the 1985 plan (prohibition of cross-country travel, campfires, and firewood and maintaining mineral withdrawal with exclusion of surface occupancy). Changes to the 1985 plan direction for this designated research natural area include the opportunity to incorporate signage to provide education, interpretation, and information to the public about the area's purpose, boundary, and permitted and prohibited activities. The effect of this updated plan direction is that the Cibola will be able to address the adverse impacts of resource degradation in the Bernalillo Watershed Research Natural Area from unauthorized roads, user-created trails, and unauthorized parking. This could result in the protection of the natural resources within the area. As well, the updated plan direction 1985 plan continues the prohibition on grazing. By prohibiting grazing, the resources of the research natural area would be protected, and soil compaction would decrease, therefore resulting in improved growth of grasses and shrubs consistent with research natural area regulations calling for preservation of the area in a virgin or unmodified condition.

Designated Wilderness Areas

Under alternatives B, C, and D, the revised plan addresses all existing designated wilderness areas with an overarching set of desired conditions, standards, and guidelines. The 1985 plan has one set of standards and guidelines for the Sandia Mountain Wilderness (Management Area #1) and another management area for the three other designated wilderness areas (Management Area #3). One significant change to this designated area is the modification of a standard in the revised plan limiting 15 persons and 15 recreational livestock combined per group (including the T'uf Shur Bien Preservation Trust Area within the Sandia Wilderness), except as determined under the special use permit, formal agreements, and management activities for maintaining wilderness character. This standard directly addresses the need for change regarding the wilderness opportunity spectrum which is now replaced with the recreation opportunity spectrum in the action alternatives. This now provides the effect of more concise and consistent management for recreation opportunities in designated wilderness. As explained previously, the wilderness opportunity spectrum framework: is confusing, specifically regarding the variance in group size restrictions depending on wilderness opportunity spectrum classification; is not widely used; and difficult to manage. Therefore, the wilderness opportunity spectrum classifications on the Cibola are being replaced with the recreation opportunity spectrum. The wilderness areas have been reviewed in terms of the recreation opportunity spectrum, determining all wilderness area as primitive except for Sandia Wilderness which has a recreation opportunity spectrum of semi-primitive nonmotorized.

Recommended Wilderness Areas

The areas recommended for wilderness in the draft land management plan would be managed under the recommended wilderness management area (see chapter 3 of the draft plan). The focus of this management area would be to manage these areas to protect wilderness characteristics pending legislation and congressional designation, and to provide for existing uses where compatible with protecting wilderness characteristics. Areas of recommended wilderness management areas by proposed alternative were analyzed under the Cibola's wilderness analysis process; see appendix B for further explanation of the criteria used for the wilderness analysis process. Designation of new wilderness may change patterns of recreation use, create larger contiguous areas, and reduce pressure within existing wilderness areas. Opportunities for wilderness-dependent recreation may increase. Motorized and mechanized uses would be prohibited in areas recommended for wilderness designation.

Under alternatives B, C, and D, the use of motorized equipment, equipment used for mechanical transport, motorized trails, mechanized recreation, and new permanent or temporary roads would be prohibited in the recommended wilderness management areas as these uses were determined to be inconsistent with managing to maintain wilderness characteristics. Motorized travel and uses would not be allowed unless specifically authorized for emergency use, for the limited needs required for management of a grazing allotment, and where they will not result in long-term degradation to wilderness characteristics to maximize future management flexibility. Dispersed recreation that includes nonmotorized and nonmechanized activities—such as hiking, backpacking, fishing, hunting, horseback riding, and cross-country skiing—would be allowed under these alternatives.

Any new request for motorized or mechanized access or maintenance associated with grazing in recommended wilderness areas for the action alternatives will need to meet the determination of "limited needs" as identified as a standard in the updated plan direction (see the draft land management plan, chapter 3 management areas, recommended wilderness). Whether the management needs would maintain and not result in long-term degradation to the wilderness characteristics would need to be determined on a case by case basis. For instance, if structural improvements (such as stock tanks, new wells) would result in an impact to apparent naturalness within a recommended wilderness area, then they would not be permitted to occur. This might result in adverse impacts on the permittee's ability to manage the allotment effectively and gather economic gain from the permit. However, by comparison, permitted grazing on the Cibola has continued on all active allotments in three designated wilderness for approximately 40 years, indicating any effect of these restrictions and limitations would not result in the end of permitted grazing in these areas.

A primary effect to recreation under alternatives B, C, and D would result from eliminating motorized or mechanized equipment that may have been used or may be used in the future for recreation maintenance and construction purposes in the recommended wilderness areas. A resulting effect from this prohibition of motorized and mechanized equipment is an increase in costs when more labor intensive equipment is used such as cross-cut saws versus chain saws. Consequently, the cost to maintain recreational use in the recommended wilderness management areas may increase if alternative B, C, or D is selected. Both alternatives B and D would potentially increase costs more than alternative C as there are more recommended wilderness areas proposed in these alternatives. However, maintenance may be needed to reduce impacts caused by human recreational use such as physical closures, rehabilitation activities, or both.

Potential wilderness designation may also cause future public use restrictions by limiting visitor use and distribution with the establishment of group size limits to preserve the wilderness character of the area. The revised draft plan includes a standard restricting group size limits in designated wilderness areas to 15 persons and 15 recreational livestock per group, except as determined under special use permit, emergency services, formal agreements, and management activities for maintaining wilderness character. If these recommended wilderness management areas were not designated, the areas would allow for greater group size limits. Currently, there are no restrictions on group size within these proposed areas.

Recreation objectives for wilderness are to provide outstanding opportunities for solitude and a primitive and unconfined type of recreation. Areas proposed as wilderness under alternatives B, C, and D would allow no new facilities for user comfort. Also under alternatives B, C, and D, group size limits established for existing wilderness areas in the draft land management plan would apply if these recommended areas were to be designated by Congress.

Another primary effect of selecting alternative B, C, or D is that no commercial vegetation management activities would be allowed in recommended wilderness areas. Mechanical transport and motorized equipment for management activities (for example, chainsaws, wheelbarrows) are allowed in recommended wilderness areas if they preserve or enhance wilderness characteristics of the area. In terms of unplanned and planned ignitions, these would only be allowed in these areas to reduce the risks and consequences of uncharacteristic wildfire, to increase apparent naturalness, or to enhance ecosystem function. If the areas are not recommended as wilderness areas, vegetation management activities that include thinning and prescribed fire could occur and the use of mechanized equipment could be used for maintenance purposes.

These recommended wilderness management areas would provide visitors with opportunities for quieter recreation. The Cibola National Forest is currently and will continue to remain popular for recreation activities in areas outside wilderness. Relaxing, fishing, hiking and walking, gathering forest products, driving for pleasure, viewing wildlife, and viewing natural features comprise 76 percent of recreational use. Although some of these uses may occur in wilderness areas, none is exclusive to or dependent upon wilderness areas to provide for these activities.

While the Cibola provides high potential opportunities for unconfined recreation experiences and solitude regionally and locally, the social demand for these unconfined experiences is related to general dispersed settings, not just wilderness, that provide both motorized and nonmotorized activities. From a regional perspective, the Cibola National Forest is perceived as having high opportunities for cultural and spiritual values, historic significance, scenic vistas, hunting, and off-highway vehicle use.

From a forest-level perspective, the recreational users express social values for wilderness areas in numerous ways: solitude for psychological health; unfragmented forests for habitat and intact landscapes; spiritual uses for solace of open, quiet, beautiful places; for wildlife and pristine settings; and economic opportunities for tourism, hunting, and fishing.

Social values for nonwilderness areas are expressed by recreational users for a variety of reasons: providing a balance of nonmotorized and motorized uses; allowing multiple uses including hunting, fishing, recreation, tourism; and timber harvesting to manage for forest health and to support community economics. Recreational users often express competing or conflicting social values for wilderness and nonwilderness uses for the same places (such as motorized and nonmotorized access, unmanaged and managed landscapes, expansion of recreation trails and limitations on uses). Within the Cibola National Forest, there remains a wide variety of opportunities for unconfined outdoor recreation experiences within both wilderness and nonwilderness National Forest System lands.

Recommended wilderness areas additions to the National Wilderness Preservation System ensure areas are managed to protect and maintain the social and ecological characteristics that provide the basis for wilderness recommendation.

The Cibola provides recreational activities that range from high adventure self-reliance in the backcountry to driving scenic byways. Expansive wilderness areas provide opportunities for people to experience solitude and adventure in a natural environment. Management area designations that are adjacent to the wilderness can potentially influence and affect wilderness character.

As more acres are allocated to more development-oriented management area designations, including road construction and mechanical timber harvesting, there is a higher likelihood of negative effects to existing wilderness, such as diminishing the apparent naturalness, opportunities for solitude, or primitive and unconfined recreation. Conversely, the fewer acres allocated to more development-oriented management area designation, the lower the likelihood of negative effects that would diminish the area's capability to be managed as wilderness to existing wilderness.

Nonwilderness uses adjacent to wilderness may have a negative effect on the quality of wilderness recreation experiences. Where roads and motorized activities occur along the wilderness boundary, the incidence of illegal use of motorized and mechanized vehicles in the wilderness may increase. High standard roads close to the boundary provide easy recreation access to wilderness and tend to increase use. As use numbers increase, particularly day use, concentrated use affects physical, biological, and social conditions in the wilderness.

Management areas bordering the wilderness that provide motorized use are more likely to affect wilderness condition and uses. The most highly developed areas (for commodity production or recreation use) are generally located adjacent to the Sandia Ranger District. If new development occurs adjacent to any of the existing four wilderness areas on the Cibola, effects could include increased noise, modified landscapes, and motorized trespass.

Environmental Consequences – Alternative A

Designated Areas and Proposed Designated Areas

Under alternative A, the no action alternative, the existing land management plan would remain in effect. Current management practices would continue as they are outlined in the existing plan. All 18 areas would continue and only the following designated areas would have specific directions: designated wilderness (Management Areas 1 and 3), Langmuir Research site (Management Area 7), Kirtland Air Force Base and Sandia Laboratories (Management Area 17). The no-action alternative does not adequately handle the intricacies of the interrelation of social, ecological, and economic transformations since the development of the 1985 plan in the mid-1980s as they relate to the designated areas.

Potential effects from retaining the management area configuration from the 1985 plan would have impacts on the ability to manage wildfire with a landscape approach. With multiple management boundaries the approach to managing wildfire is on suppression, instead of managing for resource benefit. Therefore, there would be less opportunities for managed wildfire under alternative A.

The Continental Divide National Scenic Trail under alternative A would not include the proposed 0.5 mile buffer on either side of the trail; the effects of not having this corridor would result in less of the scenery being considered since the immediate foreground is only accounted for and would result in best available science not be considered in management since it would be managed under the visual management system instead of the Scenery Management System.

Little Water Canyon would remain a proposed research natural area focusing on educational and research opportunities for the riparian Colorado blue spruce forest/red osier dogwood plant association, for which it was originally identified as a research natural area in the 1985 plan. The effects of this proposed research natural area allow for the opportunity to designate it formally. If designated as a research natural area, there would be resulting impacts to the grazing allotment permittees to remove cattle from the area. This in turn could have potentially adverse economic impacts on that permittee's livelihood.

The beneficial impacts would be improved riparian conditions, such as increased water infiltration and less turbidity, along with reduction of soil compaction and erosion from grazing. This would result in improved habitat conditions for the plant association. The wild and scenic river eligibility of Little Water Canyon is also applied to all alternatives, therefore resulting in layered protection of the area resources. In comparison, alternative B proposes the Little Water Canyon Management Area, concentrating efforts on retaining its pristine ecological features in addition to the area's wild and scenic river eligibility. Alternatives C and D do not afford any specific designation or management area for Little Water Canyon, with the exception of the protection of the outstandingly remarkable botanical values under wild and scenic river eligibility.

Recommended Wilderness Areas

Alternative A represents the current management alternative, with no additional wilderness areas recommended. This alternative offers the least protection of wilderness characteristics to areas recommended as potential wilderness under the action alternatives since there would be no recommended wilderness. The wilderness opportunity spectrum still applies under alternative A for recommended wilderness areas; the effects of not managing these lands under the recreation opportunity spectrum (as is the case in the action alternatives) include difficulty and confusion in managing these lands such as the varying group size limits across the wilderness areas that are difficult to manage and enforce.

An additional effect of this alternative in terms of recommended wilderness is that the desire by a certain segment of the public for additional wilderness areas on the Cibola would not be fulfilled. Alternative A does, however, respond to the segment of the public that desires no additional wilderness and prioritizes nonwilderness uses and values, such as timber harvesting, road construction, recreation development, use of prescribed fire, and motorized and mechanized uses.

If not recommended for wilderness designation, the forestwide desired conditions for vegetation and backcountry and primitive recreation would apply to the recommended wilderness areas in the action alternatives. Vegetation management activities that make the areas suitable for timber production, as well as new road construction, are the primary activities that could alter the wilderness character of the areas.

If not recommended for wilderness designation, many of the areas considered for recommended wilderness would still be protected as one of the 13 existing inventoried roadless areas on the Cibola National Forest. The restrictions in applicable regulations would prohibit most new road construction and therefore limit many activities which would rely on roaded access.

Although timber harvest and road construction management activities within the recommended wilderness areas would be unlikely under any of the alternatives due to the fact that they are mostly steep and not part of the suitable timber base, these types of activities would diminish the apparent naturalness of these areas. Mechanical disturbances would also negatively affect opportunities for solitude or primitive and unconfined recreation, which is another characteristic of wilderness. Overall, mechanical disturbances would diminish the area's capability to be managed as wilderness, and new road construction could eliminate an area's potential for wilderness designation in the future.

Environmental Consequences – Alternative B

Research Natural Area

In the 1985 plan, the Little Water Canyon area is a proposed research natural area. However, in alternative B, it is a proposed place based management area. This management strategy reduces the emphasis for research and education purposes but still provides direction to reduce active management, maintain high ecological integrity, and primitive recreation opportunity spectrum class. The impacts from this lower level of site protection could cause higher levels of disturbance from grazing and human uses on the riparian Colorado blue spruce forest/red osier dogwood plant association of Little Water Canyon, for which it was originally identified as a research natural area in the 1985 plan. For instance, if this area were proposed and designated as a research natural area, it would require total exclusion of livestock from the boundary. Under Alternative B as a proposed management area, the plan direction standard to manage livestock grazing to maintain the high biodiversity of the area would still allow grazing to occur. Therefore, the area would continue to receive minor grazing use which could have adverse effects to the blue spruce forest/red osier dogwood plant association in terms of soil compaction. This compaction would cause inability of the plants to penetrate the soil and therefore less ability to take in nutrients and water. The wild and scenic river eligibility of Little Water Canyon is also applied to alternative B, therefore resulting in layered protection of the area resources.

Recommended Wilderness Areas

Alternative B recommends 55,779 acres for wilderness designation (table 58). The additions are mostly concentrated in the Magdalena Ranger District, specifically around expanding the Apache Kid Wilderness. Additionally, this alternative proposes expanding the Manzano Wilderness by 2,544 acres (Manzano Wilderness expansion 1, 2, 3, 4, and 5) on the Mountainair Ranger District. These recommended wilderness management areas are both stand-alone and contiguous to existing designated wilderness areas contain high wilderness characteristics (overall H and H+ evaluation finding) with no existing or future uses incompatible with managing for recommended wilderness. These are areas from the phase 3 wilderness inventory that have had boundary adjustments to focus on areas where high wilderness characteristics (apparent naturalness, primitive recreation, solitude, manageability, and unique features) are present. Existing and future incompatible uses for managing the area as recommended wilderness were considered during the wilderness analysis process; the recommended wilderness management areas proposed in alternatives B and C do not contain incompatible uses (see appendix b, attachment N for further explanation on analysis process).

Table 58. Acres of recommended wilderness for alternative B

Recommended Wilderness Management Area and Ranger District	Alternative B (acres)
Datil Mountains Wilderness (Magdalena District)	10,179
Bear Mountains 3 (Magdalena District)	2,323
Magdalena Mountains 1 (Magdalena District)	3,057
Panther Canyon (Magdalena District)	11,164
Chavez Canyon (Magdalena District)	3,567
Apache Kid Wilderness expansion (1, 2, 3, 5) (Magdalena District)	22,945
Manzano Wilderness expansion (1, 2, 3, 4, 5) (Mountainair District)	2,544
TOTAL	**55,779**

This alternative would increase the amount of land managed as wilderness on the Cibola and improve boundary recognition of the area managed for wilderness values. Boundaries that follow natural features, such as ridgelines and breaks in slope, help to facilitate on-the-ground location and management. Boundaries that are easy to define and locate, both on a map and on the ground, generally increase the manageability of wilderness.

Alternative B would provide better management of the Manzano Wilderness than alternative A, as the Manzano Wilderness expansion (2, 3, 4, and 5) would extend the western sides of Manzano Wilderness to conform to the Cibola National Forest boundary and the Manzano Wilderness expansion area 1 would extend the northern side of Manzano Wilderness to conform to the Cibola boundary.

Alternative B would provide better management of the Apache Kid Wilderness than alternative A, as the Apache Kid Wilderness expansions (1, 2, 3, and 5) would extend the northwestern, northeastern, and southeastern sides of Apache Kid Wilderness to conform to portions of the existing Apache Kid Contiguous inventoried roadless area boundaries. Under alternatives B and C, the proposed expansions 1, 2, 3, and 5 were mapped to exclude incompatible uses for managing recommended wilderness in these areas such as mountain bike use (on Trail 31 and Trail 43 in Apache Kid Wilderness expansion area 1 and Trail 68 in Apache Kid Wilderness expansion area 5), mechanized grazing maintenance, motorized access for mineral prospecting (Apache Kid Wilderness expansion area 2), and mechanized and motorized uses for Environmental Quality Incentives Program projects. Mechanized grazing maintenance frequencies depends on type of year, anywhere from every week to make sure fences are intact to monthly or every six months, but definitely occurs throughout the year (depends on presence of cattle in that pasture and what issues may occur). The effect of these aforementioned incompatible uses not being located within the recommended wilderness areas is that the wilderness characteristics would be preserved.

The Apache Kid Wilderness expansion area 3 shares its western boundary with the existing Apache Kid Wilderness and does not include the Springtime Campground nor a northern section of the phase 3 inventory polygon located between two unauthorized roads.

Alternative B also addresses public concern for more wilderness than alternative A by recommending an additional 55,779 acres to the National Wilderness Preservation System. An additional effect of this alternative is that the desire by some segments of the public for more wilderness on the Cibola, specifically in the Magdalena Ranger District would be fulfilled. Alternative B, however, would not provide as much wilderness as alternative D.

Alternative B converts more acres of semi-primitive nonmotorized to primitive on the recreational opportunity spectrum than alternative A, but less than alternative D. As mentioned, wilderness areas are more restrictive with a primitive setting than semi-primitive nonmotorized. Therefore, alternative B provides fewer opportunities for future recreation development options than alternative A but more than alternative D. Additionally, rustic and rudimentary facilities and subtle site modifications that are allowed in semi-primitive nonmotorized settings would not be allowed in the recommended wilderness areas. Group size limits would also be established in the recommended wilderness areas established in the draft land management plan. Consequently, those desiring semi-primitive type recreation with the ability to have rustic facilities and no group size limits may be displaced to other semi-primitive nonmotorized settings on the Cibola. This alternative provides more opportunity for displacement than alternative A, but less than alternative D.

Environmental Consequences – Alternative C

Research Natural Area

In alternative C, the Little Water Canyon area is not a proposed research natural area nor a place-based management area; instead, protection of the Colorado blue spruce forest/red osier dogwood plant association of Little Water Canyon is covered by updated plant community species composition plan direction and wild and scenic rivers plan direction (see the draft land management plan, chapter 2, vegetation and chapter 3, management areas). The wild and scenic river eligibility of Little Water Canyon is applied to all alternatives, therefore resulting in protection of the outstandingly remarkable botanical values under wild and scenic river eligibility.

Within the updated plant community species composition plan direction, the blue spruce plant community of Little Water Canyon is considered significant because of its botanical importance. There are updated desired conditions to allow for these significant plant communities to persist, to maintain their unique characteristics, and the potential for interpretive signage. The effects from this updated plan direction would be the commitment of the Cibola to ensure persistence of the plant association along with education of the local users of its significance through interpretive signage. The effects from the updated wild and scenic rivers plan direction will provide a higher protection for safeguarding clean water, preserve the important ecosystems of the blue spruce forest/red osier dogwood plant association, and enable these plants to thrive. However, without the proposed research natural area and potential designation of the area, livestock grazing would be permitted to continue in the area. Therefore, there would be potentially adverse effects to the blue spruce forest/red osier dogwood plant association in terms of soil compaction. This compaction could cause inability of the plants to penetrate the soil and therefore less ability to take in nutrients and water.

Recommended Wilderness Areas

Alternative C recommends 24,265 acres within the Magdalena and Mountainair Ranger Districts for wilderness designation (table 59). The additions are mostly concentrated in the Magdalena Ranger District, specifically around expanding the Apache Kid Wilderness (Apache Kid Wilderness expansions 1, 2, 3, 5) by 22,945 acres. Additionally, this alternative proposes expanding the Manzano Wilderness by 1,320 acres (Manzano Wilderness expansions 2, 3, 4, and 5) on the Mountainair Ranger District. These recommended wilderness management areas are contiguous to existing designated wilderness areas (not separated by more than a mile of level 2 road in motor vehicle use map) and contain high wilderness characteristics (overall H and H+ evaluation finding) with no existing or future uses incompatible with managing for recommended wilderness. The criteria for recommended wilderness in alternative C also followed the intent of the alternative in that any recommended wilderness areas shall not be conflicting with Restoration Management Areas.

Table 59. Acres of recommended wilderness for alternative C

Recommended Wilderness Management Area and Ranger District	Alternative C (acres)
Apache Kid Wilderness expansions (1, 2, 3, 5) (Magdalena District)	22,945
Manzano Wilderness expansions (2, 3, 4, 5) (Mountainair District)	1,320
Total	**24,265**

This alternative would increase the amount of land managed as wilderness on the Cibola and improve boundary recognition of the area managed for wilderness values. Boundaries that follow natural features, such as ridgelines and breaks in slope, help to facilitate on-the-ground location and management. Boundaries that are easy to define and locate, both on a map and on the ground, generally increase the manageability of wilderness.

Alternative C would provide better management of the Manzano Wilderness than alternative A, as the Manzano Wilderness expansion areas (2, 3, 4, and 5) would extend the western sides of Manzano Wilderness to conform to the Cibola National Forest boundary.

Alternative C would provide better management of the Apache Kid Wilderness than alternative A, as the Apache Kid Wilderness expansion areas (1, 2, 3, and 5) would extend the northwestern, northeastern, and southeastern sides of Apache Kid Wilderness to conform to portions of the existing Apache Kid Contiguous inventoried roadless area boundaries and outside of road corridors. Under alternatives B and C, the proposed expansions 1, 2, 3, and 5 were mapped to exclude incompatible uses for managing recommended wilderness in these areas such as mountain bike use (on Trail 31 and Trail 43 in Apache Kid Wilderness expansion area 1 and Trail 68 in Apache Kid Wilderness expansion area 5), mechanized grazing maintenance, motorized access for mineral prospecting (Apache Kid Wilderness expansion area 2), and mechanized and motorized uses for Environmental Quality Incentives Program projects. The effect of these aforementioned incompatible uses not being located within the recommended wilderness areas is that the wilderness characteristics would be preserved.

Alternative C would provide the best manageability of recommended and designated wilderness compared to all alternatives by limiting recommended wilderness to those areas contiguous to existing designated wilderness and not separated by road corridors. These existing wilderness areas are already managed as wilderness and adding recommending wilderness adjacent to these areas to conform to existing roadless areas and roaded corridors would provide for similar management emphasis for contiguous lands. This alternative also provides for better manageability than alternatives B and D by allowing limited restoration activity in stand-alone areas designated as conservation management areas.

This alternative proposes the least acres for recommended wilderness areas among the action alternatives which allows for more available land to use mechanized tools for forest restoration. Since the Cibola contains many large patches of overstocked stands that are extremely vulnerable to insect and disease outbreaks and uncharacteristic stand-replacing wildfire, this alternative insures easier use of different methods to restore a more adequate fire regime on the Cibola.

Alternative C also addresses public concern for more wilderness than alternative A by recommending an additional 24,265 acres to the National Wilderness Preservation System. An additional effect of this alternative is that the desire by some segments of the public for more wilderness on the Cibola, specifically in the Magdalena Ranger District would be fulfilled. However, alternative C would not provide as much wilderness as alternatives B and D.

Alternative C converts more acres of semi-primitive nonmotorized to primitive on the recreational opportunity spectrum than alternative A but less than alternatives B and D. As mentioned, wilderness areas are more restrictive with a primitive setting than semi-primitive nonmotorized. Therefore, alternative C provides fewer opportunities for future recreation development options than alternative A, but more than alternatives C and D. Those desiring semi-primitive type recreation with the ability to have rustic facilities and no group size limits may be displaced to other semi-primitive nonmotorized settings on the Cibola. This alternative provides more opportunity for displacement than alternative A, but less than alternatives C and D.

Environmental Consequences – Alternative D

Research Natural Area

In alternative D, the Little Water Canyon area is not a proposed research natural area nor a place based management area; instead, protection of the Colorado blue spruce forest/red osier dogwood plant association of Little Water Canyon is covered by updated plant community species composition plan direction and wild and scenic rivers plan direction (see the draft land management plan, chapter 2, vegetation and chapter 3, management areas). The wild and scenic river eligibility of Little Water Canyon is applied to all alternatives, therefore resulting in protection of the outstandingly remarkable botanical values under wild and scenic river eligibility.

The potential beneficial and adverse effects of management for research natural areas in alternative D are the same as for alternative C.

Recommended Wilderness Areas

Alternative D recommends 203,117 acres within all four districts for wilderness designation (table 60). The majority of these additions are concentrated within the Magdalena Ranger District (166,025 acres) with proposed expansions of the Apache Kid Wilderness and Withington Wilderness and areas in the Datil, Bear, and Magdalena Mountains. Additionally, this alternative proposes expanding the Manzano Wilderness by 7,054 acres (Manzano Wilderness expansion 1, 2, 3, 4, and 5) and adding an area in the Gallinas Mountains (2,410 acres) on the Mountainair Ranger District. Additional areas of recommended wilderness management areas are proposed within the Mt. Taylor Ranger District (27,348 acres) and one area within the Sandia Ranger District (281 acres). These recommended wilderness management areas are stand alone and contiguous to existing designated wilderness areas that contain moderate to high wilderness characteristics (overall M, M+, H, and H+ evaluation findings), regardless of existing conflicts. The following analysis discusses how these incompatible uses to managing as recommended wilderness could continue within these areas. However, these incompatible uses were addressed and evaluated during the wilderness inventory and evaluation processes, so there are minimal incompatible uses identified within the recommended wilderness areas proposed in alternative D.

The recommended wilderness management areas proposed in alternative D could adversely affect the Mount Taylor area in terms of minerals as it has the highest mineral potential on the Cibola (see “Minerals” section, “Locatable Minerals”). The Mt. Taylor District, Mount Taylor mountain unit, is located within the Grants Mineral Belt which contains world-class mineral deposits of uranium resources. The updated plan direction for recommended wilderness areas allows development of mining claims as long as they are subject to valid existing rights. The majority of mining rights claims are not validated across the Cibola. Therefore, the recommended areas with active mining claims and mechanized and motorized maintenance and uses for active mining claims and mineral prospecting would be negatively affected due to prohibition of mining claim development. As well, if these areas would be designated by Congress, they would be withdrawn from location and entry under U.S. mining laws, and there would be a permanent removal of acres available for locatable mineral exploration and development. The effects of this withdrawal would be acreage not being available to contribute to or facilitate the development of valuable mineral resources and contribute to local, national, and global markets for valuable commodities.

Table 60. Acres of recommended wilderness by ranger district for alternative D

Recommended Wilderness Management Area and Ranger District	Alternative D (acres)
Hogback (Mt. Taylor District)	5,564
Guadalupe (Mt. Taylor District)	14,988
Mount Taylor (Mt. Taylor District)	475
Little Water Canyon (Mt. Taylor District)	6,321
Mt. Taylor total	**27,348**
Panther Canyon (Magdalena District)	27,598
Apache Kid Wilderness Expansion (1-6) (Magdalena District)	26,780
Bear Mountains 2 (Magdalena District)	2,307
Bear Mountains 1 (Magdalena District)	1,713
Datil Mountains 1 (Magdalena District)	18,350
Bear Mountains 3 (Magdalena District)	3,154
Datil Mountains Wilderness (Magdalena District)	14,052
Magdalena Mountains 1 (Magdalena District)	4,742
Magdalena Mountains 2 (Magdalena District)	1,652
Withington Wilderness Expansion (1-7) (Magdalena District)	10,267
Spruce Park (Magdalena District)	6,198
Magdalena total	**166,025**
Manzano Wilderness Expansion (2, 3, 4, and 5) (Mountainair District)	7,053
Gallinas (Mountainair District)	2,410
Mountainair total	**9,463**
Sandia Wilderness Expansion 2 (Sandia District)	281
Sandia total	**281**
Total (Mt. Taylor, Magdalena, Mountainair, and Sandia Ranger Districts)	**203,117**

Updated plan direction also prohibits the sales or extraction of common variety minerals as they shall not be permitted in recommended wilderness; therefore, there would be an impact to those mining claims in terms of not being able to extract or sell the minerals, if found in recommended wilderness areas. This results in not meeting the intent of the Mining and Minerals Policy Act of 1970 to direct the policy of the U.S. Government to foster and encourage the economic development of domestic mineral reserves and assure satisfaction of industrial, security, and environmental needs.

The Gallinas Mountain Unit for recommended wilderness is of special significance. The recommended wilderness unit, located on the Mountainair Ranger District, is an area of known mineral occurrence of important rare earth elements. If the Gallinas Mountain recommended wilderness was eventually designated as wilderness, 1,224 acres would be withdrawn from the operation of the mining laws, precluding the further exploration for important rare earth elements, a series of minerals in the Lanthanide Series of the periodic table. These minerals are identified as critical in terms of energy, industrial, military defense, and emerging alternative energy applications. The significant effects from potential designation would include no access to the exploration and development of these minerals, and the inability to conduct important scientific research into the genesis and occurrence of these minerals.

Resulting effects would be that the scientific knowledge which could be gained would not be applied to locate deposits of rare earth elements elsewhere, affecting the broader availability of rare earth elements. Further studies of the rare earth elements occurrence in the Gallinas Mountains would not contribute to knowledge about mineral deposits in general.

Other incompatible uses for managing as recommended wilderness that have been identified within the recommended wilderness management areas in alternative D include mechanized and motorized maintenance to grazing allotment structures and improvements, mechanized and motorized activities for Collaborative Forest Landscape Restoration Program projects, fuelwood gathering, special uses, and existing mountain bike uses.

Any new request for motorized or mechanized access or maintenance associated with grazing in recommended wilderness areas within alternative D would need to meet the determination of limited needs as identified within updated plan direction (see draft land management plan, chapter 3, management areas, recommended wilderness). Associated effects on grazing permittees would be potential adverse effects on their economic livelihood in terms of not being able to maintain their infrastructure in a motorized or mechanized means. As mentioned in the effects common to all alternatives, there would be a resulting higher cost of labor to use nonmechanized means. Another resulting effect of recommendation of an area would be that some structural improvements may not be allowed. This would be determined on a case-by-case basis; for example, if there were multiple potential locations for stock tanks within an allotment that overlaps with a recommended wilderness management area, the Cibola would recommend putting the stock tank outside of the recommended wilderness boundary. If these areas would be designated by Congress, congressional grazing guidelines would apply for how the area were to be managed as designated wilderness in terms of grazing.

Existing mountain bike uses occurring within recommended wilderness areas in alternative D would be displaced. However, there are multiple opportunities for mountain biking across the Cibola that would allow these users that recreational opportunity. Positive effects would be if the area were to be designated, this allows for continuous management because the forest wouldn't already be allowing mountain bike use in that area, therefore there would not be a resulting adverse impact on the mountain bike users upon designation.

Personal fuelwood harvesting and gathering in a recommended wilderness area would not result in adverse impacts to the public as the majority of authorized personal fuelwood gathering occurs within the designated road corridors which are all mapped out of the recommended wilderness areas.

Special use permits and authorizations that require mechanized or motorized uses and activities (such as military training, the congressionally designated Langmuir Research Site, and powerlines and pipelines) would not result in any adverse impacts to the special use permittees. Future management of existing special use permits and authorizations were considered during the wilderness inventory and evaluation processes in whether to move an area forward to analysis as recommended wilderness.

Current and ongoing Collaborative Forest Landscape Restoration Program project activities requiring mechanized uses were considered during the wilderness analysis process in whether to move an area forward as recommended wilderness during the wilderness inventory and evaluation processes. These types of restoration projects would be in direct conflict with managing as recommended wilderness so they were mapped out of all recommended wilderness areas for all action alternatives.

Alternative D would present serious management challenges considering the extensive new boundaries for so many new and stand-alone areas as recommended wilderness. Many of the proposed areas in alternative D are not adjacent to any existing wilderness, are not existing roadless areas and do not currently have interpretive signage, marked boundaries, or a history of wilderness management. Many of these areas in alternative D are adjacent to areas with existing motorized uses and developed uses which could encroach into recommended wilderness in alternative D and would pose management challenges for preservation of wilderness characteristics.

Ecosystem services provided by Cibola become even more important to all levels of society in the face of urbanization, land use conversion, climate change occurring on lands outside of the Cibola's boundaries (USDA Forest Service 2011a). This alternative encourages benefits provided by recommended wilderness areas through the many ecosystem services produced. Air quality, water quality and quantity, plant and wildlife biodiversity, and research opportunities related to these elements would all be positively impacted by more recommended wilderness areas. Effects from prohibiting motorized uses would be less soil compaction and erosion from motorized equipment and improved water quality and infiltration from less trampling of the ground and therefore increases in root growth for plants.

Existing wilderness and other areas such as recommended wilderness can help land managers adapt to changes by understanding ecological system, sustaining biodiversity, connecting landscapes, providing ecosystem services, and fostering human-nature relationships. However, the scale of global climate change requires a broad-based response: isolated efforts will not be sufficient to address impacts afflicting the entire globe. The scale at which we need to craft solutions is larger. Managers may need to consider the spatial and temporal scale within which ecosystem services, species, and impacts occur and will migrate in response to global climate change. This may necessitate an expanded collaborative management effort including other programs, agencies, and the public.

Cumulative Environmental Consequences

The cumulative effects analysis timeframe for designated areas is the next 10 to 15 years and includes lands outside the Cibola that could influence the Cibola or which could be influenced by the Cibola. A discussion on cumulative effects of the alternatives presented in this document examines how climate change, social trends, and land use trends on public, State, tribal, and private lands together influence the management of the Cibola.

Within the planning period, human population growth—as well as growth and demand for a variety of recreation settings and opportunities is expected to increase. A growing human population places increasing demands on recreation that could result in more human concentration and use at existing recreation areas, increased conflicts, increased density in motor vehicle use, and reduced quality of recreation settings.

The increased use of off-highway vehicles may result in increased unauthorized use in wilderness and damage wilderness character. As use increases, compliance with regulations could become a greater challenge as recreational participants increase and often compete for limited or popular space and resources. Many designated areas emphasize solitude, challenge, unmodified natural environments, and minimal encounters, signs of other users, or both can be more vulnerable to increased visitation and use conflicts.

Changes in status on Cibola lands often results in changes in use allowed on those lands under Forest Service manual direction. Recommendation of wilderness, research natural areas, and some special management areas are changes in land status and as such restrict certain activities from occurring, such as forest product harvesting or firewood cutting, road building, certain fire suppression or fuel management activities, or energy development. These same changes in status, though, often create opportunities for other types of recreational activities, ecological benefits, or both (USDA Forest Service 2015). Regardless of which alternative is selected, effects may occur.

Recommended Wilderness Areas

The wilderness characteristics of areas allocated to recommended wilderness would be protected and enhanced. The degree to which the areas are natural or appear to be natural would be increased through conserving plant and animal species and communities, physical resources, and biophysical processes. The degree to which the area appears to be free from disturbance would be enhanced by reducing actions that manipulate the biophysical environment, and undeveloped quality would improve through reducing structures, installations, and developments not related to recreation. Opportunities for solitude or primitive and unconfined recreation would be improved by retaining remoteness and by excluding facilities that decrease self-reliance. Additional qualities, including ecological, geological, or other features of scientific, educational, scenic, or historical value, would be conserved. Enhancing these qualities would have a beneficial effect on wilderness characteristics and values.

As noted above, lands considered eligible for allocation to recommended wilderness area were previously managed as undeveloped lands and generally do not permit activities that conflict with conserving wilderness characteristics. For this reason, there would not be a large shift in management activities or access limitations.

Headwater Economics, an independent nonpartisan research organization, has been studying the economic impact of public protected lands on the surrounding communities. Their most recent studies indicate positive economic relationship between increased protected lands and economic benefits to the surrounding communities. The document “Protected Lands and Economics: A summary of Research and Careful Analysis on the Economic Impact of Protected Federal Lands Spring 2017” from Headwaters Economics supports these findings:

> “Rural counties in the West with more federal lands or protected federal lands performed better on average than their peers with less federal lands or protected federal lands in four key economic measures. From 1970-2015, population, employment, and personal income on average all grew significantly faster—three times more rapidly or more—in western rural counties with the highest share of federal lands compared to counties with the lowest share of federal lands. Per capita income growth was slightly higher.”

Effects from Other Management Areas

Adjacent management activities can have a direct effect on wilderness and recommended wilderness areas. Gorte (2011) noted that while the Wilderness Act of 1964 does not speak to the issue of buffer zones around wilderness areas, subsequent legislation has prohibited creating buffer zones that would “restrict… uses and activities on Federal lands around the wilderness area.” The first explicit language was enacted in 1980 in Public Law 96-550, section 105, states:

> “Congress does not intend that the designation of wilderness areas … lead to the creation of protective perimeters or buffer zones around each wilderness area. The fact that non-wilderness activities or uses can be seen or heard from areas within the wilderness shall not, of itself, preclude such activities or uses up to the boundary of the wilderness area.”

Nearly identical language has been included in 30 wilderness statutes since 1980 (*ibid*). Although subsequent wilderness statutes prohibit wilderness buffer zones, management actions conducted adjacent to wilderness boundaries can affect both management and use of the area inside the wilderness boundary. Areas adjacent to designated wilderness and recommended wilderness that are managed for nonmotorized use are usually more compatible with wilderness management objectives and maintaining wilderness character and quality.

As noted above, management areas bordering designated and recommended wilderness that provide for motorized use are more likely to affect wilderness condition and character. If new development occurs adjacent to any of the existing four wilderness areas or recommended wilderness areas, effects could include increased noise levels, modified landscapes, and motorized trespass.

Effects from Timber Harvest

The Wilderness Act provides limited timber cutting for mining-related activity, and section (4)(d)(1) specifies "such measure may be taken as may be necessary in the control of fire, insects, and diseases, subject to such conditions as the Secretary deems desirable." Vegetation management in wilderness, wilderness study areas, and recommended wilderness is generally restricted to use of wildland fire for multiple objectives in all alternatives. Wildland fire would continue as a possible management technique under all alternatives. Fire suppression measures would be used if and where fuels and weather increase the risk of unwanted fire, either within or emanating from wilderness, wilderness study areas, or recommended wilderness. All alternatives provide for use of wildland fire for multiple objectives in these areas.

Timber harvest activity in areas adjacent to wilderness and recommended wilderness may affect qualities of wilderness character, specifically opportunities for solitude or primitive and unconfined recreation. Vegetation management actions outside of wilderness may affect the remoteness from occupied and modified areas from within the wilderness. Additionally, the natural quality of wilderness character may be impaired through altering plant and animal species and communities in areas adjacent to wilderness, and through an increased potential for the introduction of nonnative species though ground-disturbing activities.

Effects from Fire and Fuels Management

While all human-caused fires within wilderness have a management objective of suppression, current and past agency direction allows naturally ignited fires within wilderness and recommended wilderness to be used to accomplish resource benefit objectives including restoring the role of fire in wilderness areas. Cibola National Forest personnel actively manage naturally ignited fires within wilderness to achieve resource benefit. Natural ignitions within wilderness and recommended wilderness areas may also be suppressed to meet protection objectives for values at risk outside of wilderness, or because site specific conditions are unfavorable toward meeting desired resource benefit objectives.

The trend to allow naturally ignited fires to accomplish resource benefits in wilderness and recommended wilderness is expected to continue in the future. All alternatives have desired conditions and objectives that include allowing fire to play its natural role in the wilderness ecosystem. These objectives pertain to both designated and any recommended wilderness. The importance of fire and impacts of fire suppression have long been understood, and naturally ignited fire is recognized as a crucial factor in maintaining naturalness within wilderness (Cole and Landers 1995).

Impacts resulting from fire suppression activity include possible use of motorized equipment such as chainsaws for fireline construction, helicopters, and application of retardant. Minimum impact suppression tactics are used to minimize suppression impacts to the greatest extent possible, while meeting the overall suppression objective.

Restoring natural fire regimes is compounded by the attendant risk to natural and cultural resources, property, and visitors, both within wilderness and on adjacent lands. Fire, in its natural role, can enhance the natural quality of wilderness character. Wildland fire would continue as a reintroduced process in wilderness and recommended wilderness areas under all alternatives, and would have similar effects. Wildland fire for resource benefit increases the natural quality of wilderness character, but may adversely affect visitors' opportunities for solitude. Visitors may encounter sights and sounds of fire management activities like aircraft and other motorized activity, and opportunities for primitive and unconfined recreation may be adversely affected through area closures.

Effects from Livestock Grazing

Commercial livestock grazing is permitted in wilderness by the Wilderness Act of 1964 and in areas designated after 1964, where the activity was established prior to wilderness designation. While being an allowable use, livestock grazing may involve nonconforming activities within designated wilderness (e.g. motorized access, structural and nonstructural improvements). Grazing use and management direction within wilderness was further reviewed by U.S. congressional committees in the 95th and 96th Congress (Dawson and Hendee 2009). House Report 96-617 accompanied the Colorado Wilderness Act (Public Law 96-560) providing additional interpretation and clarification regarding the intent presented within Wilderness Act relating to grazing use and activity. The report (often referred to as the congressional grazing guidelines) "provided for continuation of existing grazing use; the maintenance and construction of supporting facilities including 'fences, line cabins, water wells and lines, and stock tanks;' and the temporary use of motorized equipment to repair facilities and for emergency purposes" (*ibid*). Livestock grazing, as provided for in the Wilderness Act and subsequent legislation, is an appropriate use of wilderness, where established, and recommended wilderness areas.

Permitted grazing remains an existing use in all designated wilderness areas where it was allowed at the time of designation by Congress. At the time of designation, there was no permitted grazing in the Sandia Mountain Wilderness. However, the Manzano, Withington, and Apache Kid all had active grazing allotments at the time of designation and that grazing has continued. There are currently no vacant allotments in these three wilderness areas, and no allotments have been closed to grazing since wilderness designation. Permitted grazing has continued after designation under the requirements of the 1985 plan, applicable laws, and Congressional grazing guidelines. Consistent with the grazing guidelines motorized access has continued where necessary for maintenance of range improvements. Grazing is expected to continue in these wilderness areas.

Livestock grazing use in wilderness may affect the qualities of wilderness character qualities. Grazing allotments within wilderness are managed to conserve the range resource while observing existing law, regulation, and policy.

Recreational livestock grazing standards and guidelines vary by national forest and are not directly regulated by a permitting process; only livestock used by commercial outfitters and guides is under permit. Standards and guidelines included in the draft plan provide a framework for managing recreational livestock grazing use, reducing impacts and influences to desired levels, and maintaining wilderness character.

Effects from Minerals Management

The Wilderness Act of 1964 allows for mining activity within designated wilderness. The use is conditioned by specific criteria outlined within the act and by agency regulations designed to minimize affects to wilderness character. Developing mineral operations within wilderness are generally more difficult and costly and may contribute to the overall absence of development (see the "Mineral Resource" section for leasable minerals, geothermal, coal, locatable minerals, saleable minerals, and other energy discussions).

Effects from Recreation and Access

Section (4)(b) of the Wilderness Act states "wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use." Recreation is the most obvious and reported use of wilderness. Though recreation use is a prescribed use within wilderness, visitor and recreational use in wilderness and recommended wilderness has the potential to impair wilderness character or characteristics: naturalness may be affected through impacts to physical resources (for example, water, soil); undeveloped quality may be affected by recreation related facilities and developments; and opportunities for primitive and unconfined recreation may be affected by facilities that decrease self-reliance and through management restrictions on visitor use.

Section (4)(c), Prohibition of Certain Uses, of the Wilderness Act, states "there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area." While section (4)(c) prohibits motorized use within wilderness, use of motorized vehicles, equipment, or mechanical transport in areas adjacent to designated or recommended wilderness has the potential to impair the undeveloped quality of wilderness character. Similarly, the opportunities for solitude or primitive and unconfined recreation may be impaired by a decrease in remoteness from occupied and modified areas outside the wilderness.

Socioeconomic Resources

This section provides social and economic analysis, including past and current conditions and the potential consequences of the four alternatives on the social and economic environment. Section 219.8 of the 2012 Planning Rule requires that the plan provide for social, economic, and ecological sustainability, and further clarifies under section B that the plan components must take into account the following:

- social, cultural, and economic conditions relevant to the area influenced by the plan
- scenic character and sustainable recreation, including recreation settings, opportunities, and access
- multiple uses that contribute to local, regional, and national economies in a sustainable manner
- ecosystem services
- cultural and historic resources and uses
- opportunities to connect people with nature

Section 219.10 goes on to state the responsible official shall consider reasonably foreseeable risks to ecological, social, and economic sustainability. This section will partially fulfill the consideration of social and economic sustainability requirements. The environmental consequences section below describes the economic and social analysis procedures employed in this document.

The Cibola National Forest is comprised of four ranger districts, each of which contains mountain ranges known as sky islands because of their remote locations and high elevation relative to the surrounding desert. Magdalena Ranger District to the south and Mt. Taylor Ranger District to the west are 60 or more miles from the Cibola National Forest supervisor's office in Albuquerque—the largest city in the state of New Mexico—and even farther away from the other Cibola National Forest ranger district offices. Sandia and Mountainair Ranger Districts, while not contiguous, are relatively close to each other along their north and south axis and to Albuquerque.

Because Cibola National Forest is made up of noncontiguous parcels spanning ten counties, numerous nearby communities have longstanding social and economic ties to the natural and cultural resources of the Cibola. To more effectively examine the linkages between National Forest System lands and the local communities they serve, the geographic scope of this analysis extends beyond Cibola National Forest boundaries to encompass a broader social and economic study area. Since neighboring communities may be affected by forest management decisions on the Cibola National Forest, it is important to examine existing socioeconomic conditions of this broader region to establish a baseline against which potential impacts can be measured. The study area for the economic analysis is a grouping of the ten counties containing each of the four ranger districts and are consistent with the areas defined in the assessment report (listed below) (USDA Forest Service 2015b). The socioeconomic resource analysis uses ten New Mexico counties: Bernalillo, Catron, Cibola, Lincoln, McKinley, Sandoval, Sierra, Socorro, Torrance, and Valencia.

- Magdalena Ranger District: Catron, Sierra, and Socorro Counties
- Mountainair Ranger District: Bernalillo, Lincoln, Torrance, and Valencia Counties
- Mt. Taylor Ranger District: Cibola, McKinley, and Sandoval Counties
- Sandia Ranger District: Bernalillo and Sandoval Counties

Affected Environment

The affected environment is split into four parts: (1) population and demographics, (2) employment and income, (3) other key forest contributions, and (4) environmental justice. The affected environment draws heavily from the information provided in the 2015 forest assessment and is updated with newer data and information when available and appropriate (USDA Forest Service 2015b).

Population and Demographics

This section highlights population and demographic trends in the study area. Population is an important consideration in managing natural resources. In particular, population structure (for example, size, composition, density) and population dynamics (how the structure changes over time) are essential to describing the consequences of forest management and planning on a social environment (Seesholtz et al. 2004). Population increases may lead to conflicts over land use, travel management, recreation activities, and values. These are conflicts that Forest Service managers attempt to balance when making management decisions.

Population Growth

Population growth can be an indicator of a region's desirability to live and work. In 2015, New Mexico was home to more than 2 million people (less than 1 percent of the U.S. population) (table 61). The New Mexico population grew by 38 percent between 1990 and 2015 (table 61). In comparison, the U.S. population grew by 27 percent over this same period. Migration played a relatively minor role in New Mexico's population growth. Net in-migration to New Mexico was approximately 150,000 people between 1990 and 2000, and approximately 100,000 people between 2000 and 2010 (USDA Forest Service 2015b). University of New Mexico geospatial and population studies (UNM-BBER 2013) projected state population growth rates for the next two decades of 14 and 11 percent, which will result in a population of more than 2.6 million people by 2030 (table 62).

Table 61. Historical population in study area, New Mexico, and U.S.

Geographic Area	1990	2000	2010	2015
Magdalena Ranger District	27,239	34,891	33,579	32,692
Catron County	2,563	3,543	3,725	3,583
Sierra County	9,912	13,270	11,988	11,615
Socorro County	14,764	18,078	17,866	17,494
Mountain Air Ranger District	548,316	659,152	776,013	786,024
Bernalillo County	480,577	556,678	662,564	673,943
Lincoln County	12,219	19,411	20,497	19,931
Torrance County	10,285	16,911	16,383	15,853
Valencia County	45,235	66,152	76,569	76,297
Mt. Taylor Ranger District	147,799	190,301	230,266	238,018
Cibola County	23,794	25,595	27,213	27,382
McKinley County	60,686	74,798	71,492	73,998
Sandoval County	63,319	89,908	131,561	136,638
Sandia Ranger District	543,896	646,586	794,125	810,581
Bernalillo County	480,577	556,678	662,564	673,943
Sandoval County	63,319	89,908	131,561	136,638
Assessment area	723,354	884,344	1,039,858	1,056,734
New Mexico	1,515,069	1,849,046	2,059,179	2,084,117
United States	248,790,925	281,421,906	308,745,538	316,515,021

Source: U.S. Census Bureau 1990, 2000, 2010, 2016; UNM-BBER 2013.

Amenities (the natural, cultural, and social characteristics of an area) have played an increasing role in U.S. migration. Areas characterized as having high levels of natural amenities (distinctive land and water features, mild temperatures, scenic quality, and recreation opportunities of a geographic region) have been shown to experience greater population growth than areas with fewer natural amenities (Rudzitis and Johansen 1991, Johnson and Beale 1994, Johnson and Beale 1998, McGranahan1999, Hunter et al. 2005, Frentz et al. 2004), and that this growth occurs increasingly at the boundaries of public lands (Rasker and Hansen 2000, Radeloff et al. 2001). In recent years, communities surrounding the Cibola have become increasingly attractive because of their proximity to open spaces and natural settings which provide residents with easy access to recreational opportunities year-round. A portion of population growth in this region can be attributed to the scenic beauty and outdoor recreation supported by the Cibola National Forest. This is discussed in the "Land Use Conversion" section below.

Table 62. Projected population in study area, New Mexico, and U.S.

Geographic Area	2020	2030
Magdalena Ranger District	33,965	33,839
Catron County	3,909	4,000
Sierra County	12,048	12,218
Socorro County	18,008	17,621
Mountain Air Ranger District	907,790	1,025,997
Bernalillo County	780,244	886,564
Lincoln County	21,577	21,979
Torrance County	17,589	18,865
Valencia County	88,380	98,589
Mt. Taylor Ranger District	278,892	326,079
Cibola County	29,133	30,630
McKinley County	73,483	73,805
Sandoval County	176,276	221,644
Sandia Ranger District	956,520	1,108,208
Bernalillo County	780,244	886,564
Sandoval County	176,276	221,644
Assessment area	1,220,647	1,385,915
New Mexico	2,351,724	2,613,332
United States	334,503,000	359,402,000

Source: U.S. Census Bureau 1990, 2000, 2010, 2016; UNM-BBER 2013.

Population Density

Population density can serve as an indicator of a number of socioeconomic factors of interest: urbanization, availability of open space, socioeconomic diversity, and civic infrastructure (Horne and Haynes 1999). More densely populated areas are generally more urban, diverse, and offer better access to infrastructure. In contrast, less densely populated areas provide more open space, which may offer natural amenity values to residents and visitors.

Compared with other states, New Mexico has a relatively small population. In 2010, New Mexico's population rank was 36th in the Nation, but it is the 5th largest state, with a land area of 121,697 square miles. As a result, it has a low average population density of 17 people per square mile in 2010 (table 63 through table 67) (U.S. Census 2010).

Despite population growth over the last two and a half decades, the number of people per square mile remains quite low. With the exception of Bernalillo, Sandoval, and Valencia counties, the study area counties are less dense than New Mexico and the Nation as a whole. The county with the highest population density is Bernalillo County, which encompasses Albuquerque, New Mexico. Albuquerque is a large metropolitan city with over half a million people. As such, it has a population density 6.5 times higher than the national average. Valencia has the second highest population density in the study area and is located in the southern suburbs of Albuquerque. The county with the lowest population density is Catron. At 0.5 people per square mile, it is the second lowest density in New Mexico and is among the lowest in the Nation.

Table 63. Population density for the counties in the Magdalena Ranger District, 2010

County	Density (people per square mile)
Catron	0.5
Sierra	2.9
Socorro	2.7

Table 64. Population density for the counties in the Mountain Air Ranger District, 2010

County	Density (people per square mile)
Bernalillo	570.8
Lincoln	4.2
Torrance	4.9
Valencia	71.8

Table 65. Population density for the counties in the Mt. Taylor Ranger District, 2010

County	Density (people per square mile)
Cibola	6.0
McKinley	13.1
Sandoval	35.5

Table 66. Population density for the counties in the Sandia Ranger District, 2010

County	Density (people per square mile)
Bernalillo	570.8
Sandoval	35.5

Table 67. Population density for the New Mexico and the U.S., 2010

Area	Density (people per square mile)
New Mexico	17
United States	87.4

Low population density may point to high levels of public ownership. The majority of land in private ownership is in three of the ten counties in the study area: Lincoln, Torrance, and Valencia. The remaining land is owned publicly by the Forest Service, Bureau of Land Management, National Park Service, local governments (for example, State and county) or is tribal lands. Bernalillo County contains 30 percent tribal land, which partially explains why it has both high population density and lower levels of private ownership (45 percent) (U.S. Geological Survey 2016).

The low population density of Catron County can be explained, in part, by its low private ownership (25 percent) and the high percentage of Federal and State land. Nearly 63 percent of Catron County is Federal lands, of which, 50 percent or 2.2 million acres are managed by the Forest Service (U.S. Geological Survey 2016). However, most of the Forest Service land in Catron County is a part of the Gila National Forest and not the Cibola National Forest. These findings suggest that while most of the study area is quite rural, the Cibola National Forest has areas close to larger metropolitan areas, suggesting a wide variety of socioeconomic conditions, values, and beliefs held by residents who use and live near the national forest.

Age

The portion of the State's population between the ages of 0 and 14 declined between 1990 and 2010 from 25 to 21 percent, while the portion age 65 or older increased from 11 to 13 percent. These trends are expected to continue. University of New Mexico, Bureau of Business and Economic Research (UNM-BBER) projects that by 2030 those of ages 0 through 14 will comprise 20 percent of the population, and individuals age 65 and older will comprise 21 percent of New Mexico's population (USDA Forest Service 2015b). Between 1990 and 2010, the portion of New Mexico's population of working age (15 through 64) grew from 64 to 66 percent of the population but is expected to decline to 60 percent of the population by 2030 (UNM-BBER 2013).

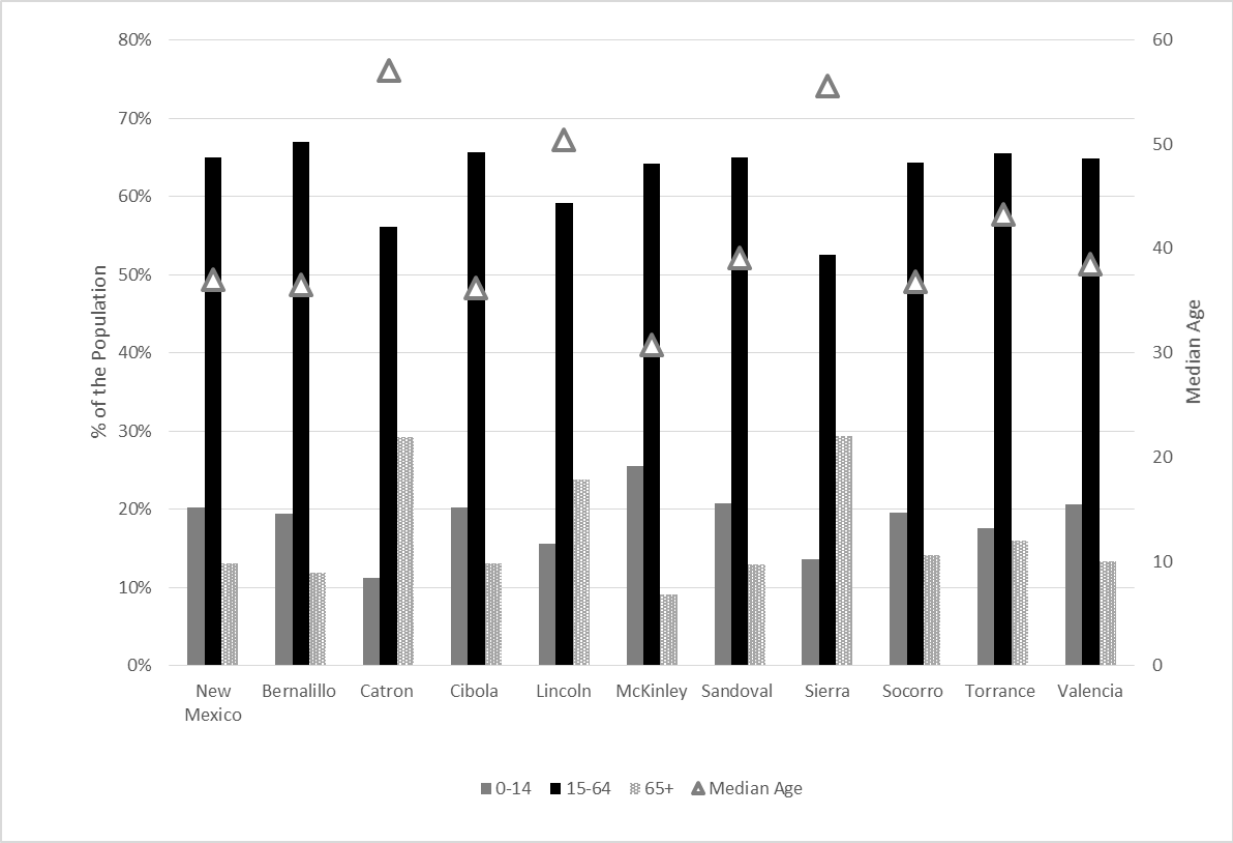


Figure 8. Median age and age distribution, 2015 (U.S. Census Bureau 2016)

Catron, Lincoln, and Sierra are the oldest counties in the planning area. All three have median ages 10 to 20 years higher than New Mexico's median, and the percentage of the population of working age (15 to 64 years old) is 6 to 12 percent lower than New Mexico's average (figure 8).

McKinley County is the youngest county in the planning area. It has the lowest median age (31) and the largest population of youths (those 0 to 14 years of age). A high median age generally indicates a relatively larger share of retirees reside in the area. An area with a large percentage of retirees earns income primarily from investments and transfer payments (for example, dividends and Social Security), rather than salaries and wages (see the "Nonlabor Income" section below). Age data may be relevant for forest management decisions. A population's age may affect community values and uses associated with National Forest System lands. For example, older populations are more likely to desire easily accessible recreation opportunities.

Race and Ethnicity

New Mexico's population is more racially diverse than the general U.S. population, and the portion of the New Mexico population that is of Hispanic descent is increasing (UNM-BBER 2013). In 1990, thirty-eight percent of the state's population was Hispanic; by 2010, forty-six percent was Hispanic. The racial composition of the state has also changed. The portion of the population that self-identified as "White" fell from 76 to 68 percent between 1990 and 2010. This decline has been offset by minimal increases among other racial groups, most notably by those who self-identified as "Other" (UNM-BBER 2013). Table 68 displays the racial composition for each county in the study area as of 2015 by each of the ranger districts and the composition of New Mexico and the United States for comparison.

New Mexico's ethnicity ratio is 47 percent Hispanic to 53 percent non-Hispanic, whereas the United States' ratio is 17 percent Hispanic to 83 percent non-Hispanic (table 68). Across the study area, the average Hispanic population is 37 percent, ranging from 59 percent in Valencia County to 14 percent in McKinley County.

Table 68. Ethnicity (in percent) by county, state, and the U.S., 2015

Location	Total Population	Non-Hispanic-White	Total Non-Hispanic	Hispanic or Latino
Magdalena Ranger District	32,692	NA	NA	NA
Catron County	3,583	79.9	82.4	17.6
Sierra County	11,615	66.9	70.9	29.1
Socorro County	17,494	39.1	50.9	49.1
Mountain Air Ranger District	786,024	NA	NA	NA
Bernalillo County	673,943	40.4	51.3	48.7
Lincoln County	19,931	64.0	68.8	31.2
Torrance County	15,853	53.9	59.4	40.6
Valencia County	76,297	34.7	40.8	59.2
Mt. Taylor Ranger District	238,018	NA	NA	NA
Cibola County	27,382	20.9	62.5	37.5
McKinley County	73,998	9.9	86.1	13.9
Sandoval County	136,638	45.5	63.1	36.9
Sandia Ranger District	810,581	NA	NA	NA
Bernalillo County	673,943	40.4	51.3	48.7
Sandoval County	136,638	45.5	63.1	36.9
New Mexico	2,084,117	39.2	52.6	47.4
United States	316,515,021	62.3	82.9	17.1

Source: Census Bureau 2016

Seventy-four percent of McKinley County's population is American Indian, which is approximately 53,500 people; 41 percent of Cibola County's population is American Indian, which is 11,150 people. These two counties contain the largest concentration of American Indian populations. Overall, 11.3 percent of the planning area is American Indian.

There are seventeen federally recognized tribes that recognize the Cibola National Forest as part of their aboriginal and ancestral use areas, and acknowledge contemporary use of these lands for traditional cultural and religious activities. The Pueblos of Acoma, Zuni, Laguna, Isleta, Sandia, Santo Domingo, Santa Ana, San Felipe, San Ildefonso, Cochiti, Zia, and Jemez, the Navajo Nation, the Hopi Tribe, the Jicarilla Apache Nation, the Mescalero Apache Tribe, and the Ft. Sill Apache Tribe are based in New Mexico, Arizona, and Oklahoma and regularly consult with the Cibola personnel on policy development, proposed plans, projects, programs, and forest activities.

Table 69. Race (in percent) by County, State, and the U.S., 2015

Location	Total Population	White Alone	African American Alone	American Indian Alone	Asian Alone	Other Race Alone	Two or More Races
Magdalena Ranger District	32,692	NA	NA	NA	NA	NA	NA
Catron County	3,583	96.4	0.7	0.5	0.3	0.4	1.6
Sierra County	11,615	91.4	0.5	1.5	0.2	3.4	3.0
Socorro County	17,494	81.0	0.7	10.3	0.7	5.7	1.5
Mountain Air Ranger District	786,024	NA	NA	NA	NA	NA	NA
Bernalillo County	673,943	71.8	3.0	4.5	2.3	14.1	4.2
Lincoln County	19,931	85.7	0.6	2.8	0.2	8.5	2.2
Torrance County	15,853	89.5	1.3	2.1	0.0	2.9	4.2
Valencia County	76,297	74.7	1.1	4.2	0.6	16.7	2.8
Mt. Taylor Ranger District	238,018	NA	NA	NA	NA	NA	NA
Cibola County	27,382	43.4	1.0	40.7	0.6	11.0	3.2
McKinley County	73,998	16.9	0.8	73.9	1.0	3.7	3.6
Sandoval County	136,638	70.0	2.7	12.3	1.4	9.7	3.9
Sandia Ranger District	810,581	NA	NA	NA	NA	NA	NA
Bernalillo County	673,943	71.8	3.0	4.5	2.3	14.1	4.2
Sandoval County	136,638	70.0	2.7	12.3	1.4	9.7	3.9
New Mexico	2,084,117	73.2	2.1	9.1	1.4	10.9	3.3
United States	316,515,021	73.6	12.6	0.8	5.1	4.7	3.0

Source: Census Bureau 2016

Educational Attainment

Educational attainment, the measure of people with at least a high school diploma or bachelor's degree, is an important indicator of an area's social and economic opportunities and its ability to adapt to change. High educational attainment rates generally exist in areas with plentiful employment opportunities for working-age adults. The presence of highly educated adults may be self-reinforcing; a highly educated population is a signal that an area provides economic and cultural opportunities, which attracts additional college-educated adults to the area.

This process leads to further economic development and job creation. In contrast, areas with low levels of educational attainment are less able to adapt to economic change (Florida 2002). Areas with lower educational attainment (for example, McKinley and Socorro Counties) are less resilient to change. As a result, land management actions are more likely to adversely affect social and economic well-being in these counties.

New Mexico's population has become more educated over the past two and a half decades. The portion of individuals age 25 or older with less than a 9th-grade education decreased from 11 to 5.5 percent. Those with some high school education but no diploma or GED decreased from 14 to 8 percent, and those with an associate's degree or other higher degree increased from 26 to 36 percent.

Those 25 or older with other education levels have remained relatively constant during the last two decades (UNM-BBER 2013). Figure 9 displays the percentage of the adult population, by county, who have not obtained a high school education and those who obtained a bachelor's degree or higher. In McKinley and Socorro Counties, over 23 percent of the population did not obtain a high school degree and only 11 and 17 percent, respectively, have obtained a bachelor's degree or higher. Bernalillo, Catron, Lincoln, and Sandoval Counties have the greatest percent of more-educated individuals. All four counties have a more educated populace than New Mexico and have education levels similar to, or better than, the United States. Compared to New Mexico, Cibola, Sierra, Torrance, and Valencia have a higher population of individuals with a high school degree but a much smaller percentage who have obtained a bachelor's degree or higher.

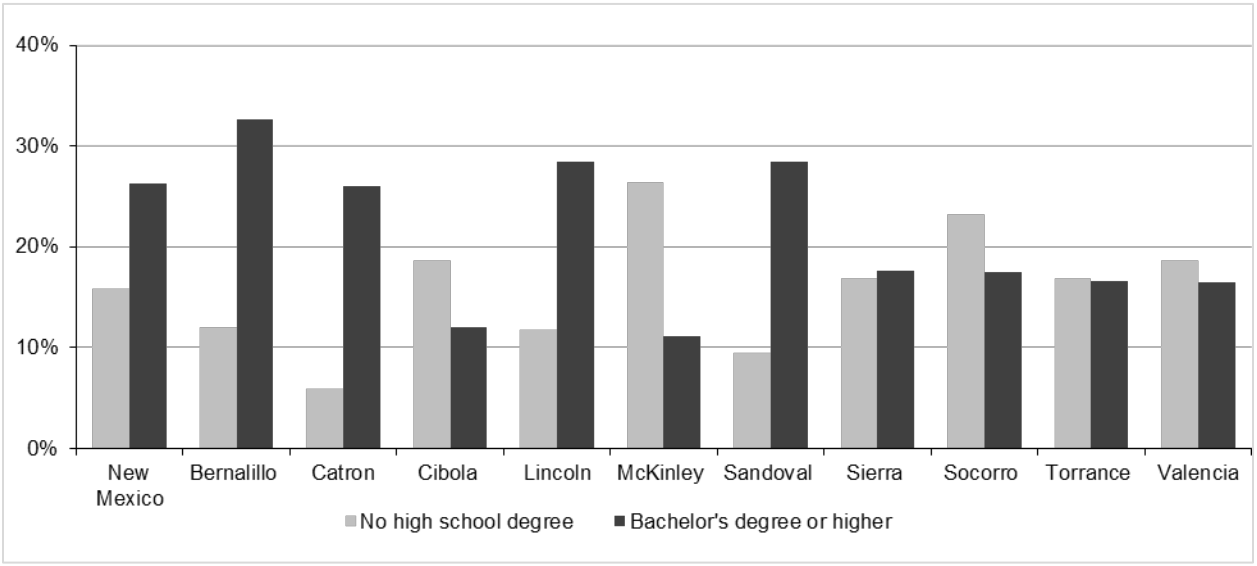


Figure 9. Educational attainment, 2015 (Census Bureau, 2016)

Forest Visitors

An estimated 1.6 million visits were made to the Cibola National Forest in 2016 (USDA Forest Service 2011b). The Sandia Mountains are the most visited mountains in New Mexico. Over a million people journey into these mountains each year. Many visitors come to hike the numerous trails, including the Crest Trail and La Luz Trail, or use the many developed picnic areas or the winter snow play area. Nonmotorized mountain bike use has dramatically increased in recent years. Requests for large group special use permits for various functions on and around the Sandia Crest have also dramatically increased, as has the number of special use permit requests for filming and military training (USDA Forest Service, 2015b).

Hiking and walking were the most frequently cited main reasons for visiting the national forest: 42 percent of all visits (USDA Forest Service 2011b). Twenty-two percent was for viewing natural features and 10 percent was for bicycling. The remainder of visits were spread out across activities such as nature study (7.8 percent), driving for pleasure (2.7 percent), picnicking (8.9 percent), gathering forest products (2.8 percent), and fishing (0.7 percent).

Table 70. Forest activity participation, 2016

Activity	Percent who participated in activity during visit (more than one activity could be checked)	Percent who indicated as primary activity during visit1
Viewing natural features	81.3	21.5
Hiking and walking	66.8	42.2
Relaxing	65.9	5.5
Viewing wildlife	41.2	2.7
Nature center activities	17.3	0.4
Driving for pleasure	13.8	2.7
Bicycling	10.4	9.8
Other	9.8	5.7
Picnicking	8.9	1.9
Nature study	7.8	0.3
Gathering forest products	5.9	2.8
Visiting historic sites	5.3	0.8
Cross-country skiing	2.4	2.4
Downhill skiing	1.4	1.2
Developed camping	1.2	0.5
Other nonmotorized	1.1	0.1
Motorized trail activity	0.9	0.6
Fishing	0.9	0.7
Hunting	0.6	0.6
Primitive camping	0.5	0.0
Backpacking	0.4	0.2
Horseback riding	0.3	0.3
Off-highway vehicle use	0.2	0.2
No activity reported	0.1	0.7
Other motorized activity	0.0	0.0
Resort use	0.0	0.0
Nonmotorized water	0.0	0.0
Motorized water activities	0.0	0.0
Snowmobiling	0.0	0.0

[1]Survey respondents were asked to select just one of their activities as their main reason for their forest visit. Some respondents selected more than one, so this column may total to more than 100 percent.

Source: USDA Forest Service 2016.

The race and ethnicity of national forest visitors generally follows the demographic of the surrounding communities but skews towards the white population. Ninety-five percent of Cibola National Forest visitors in 2016 were White; 5 percent were American Indian. Hispanic (of any race) visitors made up only 16 percent of the total annual visits, while Hispanics (of any race) make up over 48 percent of the New Mexican population.

Employment and Income

The previous section assessed demographic trends in the study area relative to the state and national averages. This section focuses on economic conditions and trends. This discussion provides additional information on the social and economic environment in the study area to further develop a baseline on which potential impacts can be measured against.

Employment and Specialization

There were approximately 564,000 jobs and $26.6 billion in labor income in the 10-county region in 2016 (Minnesota IMPLAN Group 2016). This is 51 percent of New Mexico's labor income, but the study area contains Albuquerque, the largest metropolitan region of the state.

Figure 10 provides average annual unemployment rates by county from 1990 through the end of 2016. County data, rather than ranger district averages, are provided because important differences between counties are masked when these data are averaged together.

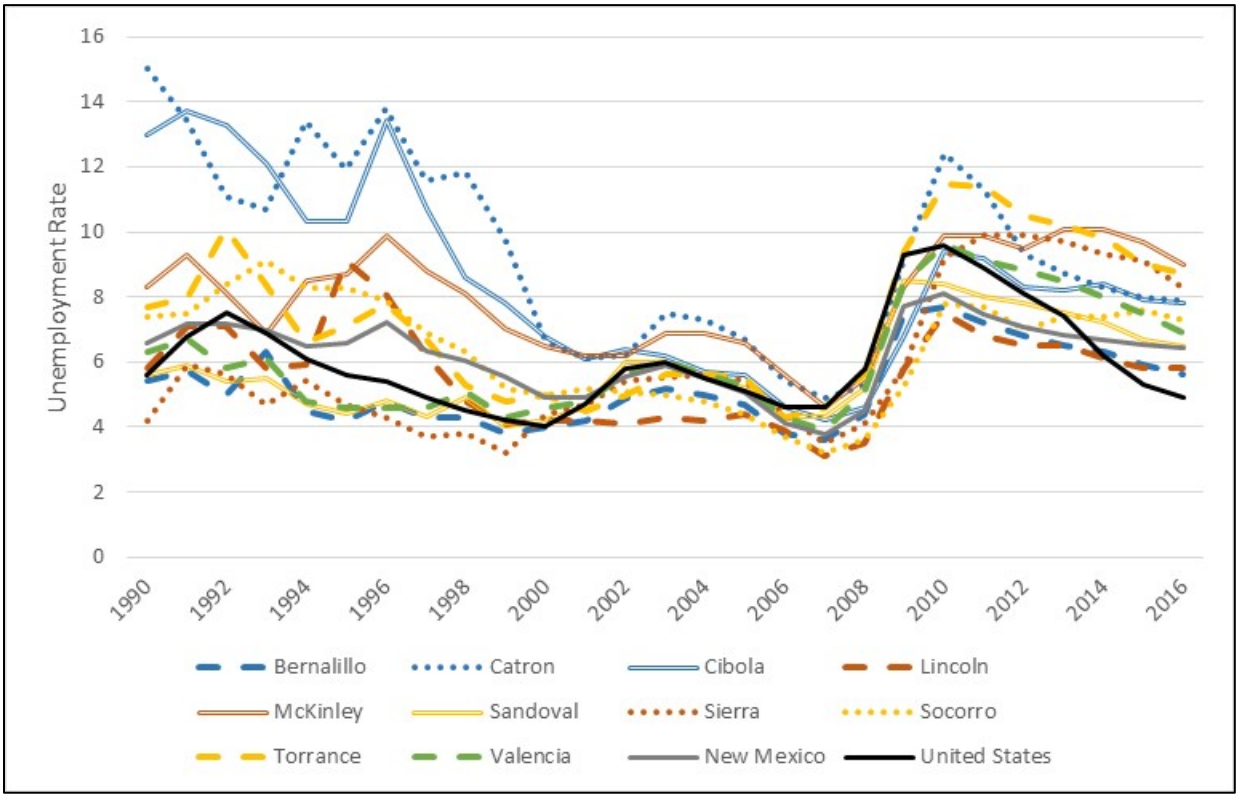


Figure 10. Average annual unemployment rate by county (Bureau of Labor Statistics 1990-2016)

Prior to 2000, the planning area counties had dramatically different unemployment rates. Cibola, Catron, and McKinley had experienced particularly high unemployment, while the more metropolitan counties experienced unemployment rates below both state and national averages. Prior to the Great Recession, nearly all counties had converged to within 2 percent of the national average. This included Cibola and Catron Counties, where unemployment fell from 13 percent in 1996 to below the United States' average in 2008.

Unemployment levels during and after the great recession were felt differently across the planning area. Catron County experienced 12.4 percent unemployment at its highest post-recession level in 2010, while Bernalillo, Lincoln, Socorro, and New Mexico as all remained below 8 percent. In 2016, all planning area counties and New Mexico had unemployment rates greater than the United States average (4.9 percent). McKinley County had the highest unemployment rate (9 percent) and has seen unemployment fall by less than 1 percent from peak recession values. Catron, Cibola, Sierra, and Torrance were all near 8 percent unemployment. These values suggest several planning area counties have not kept pace with the U.S. economic recovery following the Great Recession.

Economic diversity generally promotes stability and offers greater employment opportunities. The larger metropolitan counties tend to have lower, more stable unemployment and are able to recover more quickly from external economic shocks (figure 10). Highly specialized economies (those that depend on a few industries for the bulk of employment and income) are prone to cyclical fluctuations and offer more limited job opportunities. Assessing employment by sector helps identify industries, which are important to the local economy surrounding the Cibola National Forest. Figure 11 shows local employment in aggregated sectors as a share of total employment (Minnesota IMPLAN Group 2016). The five largest sectors, in terms of employment, in the regional economy were government (18 percent), health care and social assistance (12 percent), retail trade (10 percent), professional, scientific, and technical services (9 percent), and accommodation and food services (9 percent) accounting for 58 percent of total employment. A portion of employment in many industries can be attributed directly or indirectly to the Cibola National Forest but not all. Employment contributions provided by the Cibola National Forest are discussed in the "Forest Economic Contributions" section below.

In 2015, the three highest-earning industries in the combined study region were government; healthcare; and professional, scientific, and technical sectors, accounting for nearly 52 percent of all employment earnings. Healthcare is the single fastest growing industry, in both earnings and employment. While retail trade and hospitality sectors are still large employers, their growth has been relatively flat since 2001 (U.S. Bureau of Economic Analysis 2017).

Total employment in the agricultural sector is 2 percent for the study region (figure 11), but this varies across the study area. Several counties have a higher share of employment in the agricultural sector. Catron, Sierra, Socorro, Torrance, and Valencia Counties' agricultural sectors are much higher than the planning area average. Total employment in the agricultural sector in these counties ranges from 6.8 percent in Sierra County to 22 percent for Catron County (U.S. Bureau of Economic Analysis 2017).

Additionally, agriculture is Catron's and Valencia's fastest-growing industry. Although agriculture is a large employment industry, it is also one of the lowest earning industries. In Catron County, agriculture accounts for 22 percent of employment but only 5.5 percent of employment earnings. In contrast, government employment in Catron County accounted for 18 percent of employment and 50 percent of employment earnings (U.S. Bureau of Economic Analysis 2017).

Sandoval is the only county in the planning area with a large manufacturing sector. In 2001, it was the largest employment sector. It fell from 7,000 jobs to 3,900 in 2015 and is now the fifth largest sector. Despite being the fifth largest sector, it remains a top earning industry (U.S. Bureau of Economic Analysis 2017).

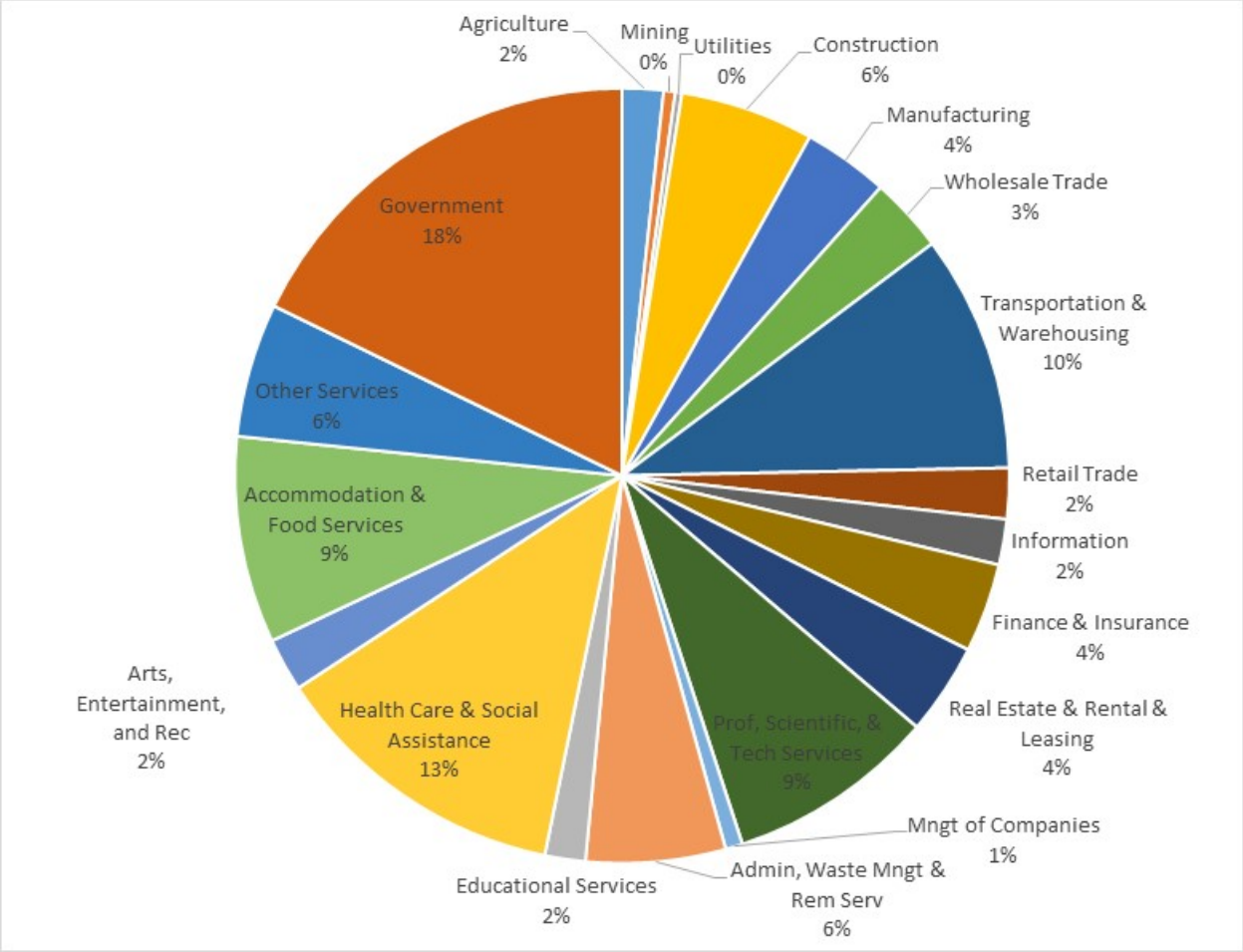


Figure 11. Total employment by industry in study area, 2014 (Minnesota IMPLAN Group 2016)

Median Household Income

Median household income is an indicator of economic well-being. For planning, income is an important consideration because low-income populations may be more vulnerable to any adverse effects that result from changes to land management plans. Table 71 provides median household income data for planning area counties; for reference, New Mexico and U.S. data are also listed.

The planning area has numerous counties with median incomes well below the statewide population median. New Mexico's median household income is approximately $6,000 below that of the United States. Cibola, McKinley, Sierra, Socorro, and Torrance Counties have median incomes that are at least $10,000 less than New Mexico. Catron, Lincoln, and Valencia Counties have median incomes below New Mexico's but by no more than $4,000. These values suggest several planning area counties are facing economic hardships far greater than the average U.S. population. Sandoval County has the highest median household income and is the only county in the study area that exceeds the United States' median. A different picture emerges when household income in Sandoval County is viewed at the census tract level.

Figure 12 illustrates a high level of economic disparity among the households in Sandoval County. The southeast portion of the county, whose population is predominately white (76 percent) and only 5 percent American Indian, is the most prosperous. Less than 15 percent of households in the city of Rio Rancho make less than half of the median income. In contrast, between 45 to 60 percent of households in the northwest portion of the county make less than $25,000 per year. Ninety-nine percent of individuals in the census tract in the northwest corner identified as American Indian. The data suggest there may be strong correlation between race and economic well-being and that American Indian communities are more likely to experience economic hardships than white populations.

Table 71. Median household income, 2015

Location	Median Household Income
Sandoval	$58,982
Bernalillo	$47,725
Catron	$42,973
Valencia	$41,703
Lincoln	$40,708
Cibola	$34,565
Socorro	$34,037
Torrance	$32,083
Sierra	$29,356
McKinley	$28,772
New Mexico	$44,963
United States	$53,889

Source: U.S. Census Bureau 2016a

Per Capita Income

Per capita income is another indicator of economic well-being and is often more revealing when comparing wellbeing across areas with different population sizes.

Per capita income for all planning area counties are below the national average (figure 13). Bernalillo, Lincoln, and Sandoval Counties have per capita incomes equal to, or greater than, New Mexico's per capita income. McKinley and Cibola Counties have the lowest per capita incomes in the planning area and are over $8,000 less than New Mexico's. These counties have large populations of both Hispanic and American Indian (see table 68). Historically, these two minority populations have been susceptible to greater economic insecurity than other nonminority populations.

Per capita income considers all sources of income, including wages and salary payments, transfer payments investment earnings, dividends, and rents. The poorest counties likely receive much of their income in the form of transfer payments, such as unemployment insurance and Supplemental Nutrition Assistance Program payments. These findings are borne out in the non-labor income and employment sections that follow.

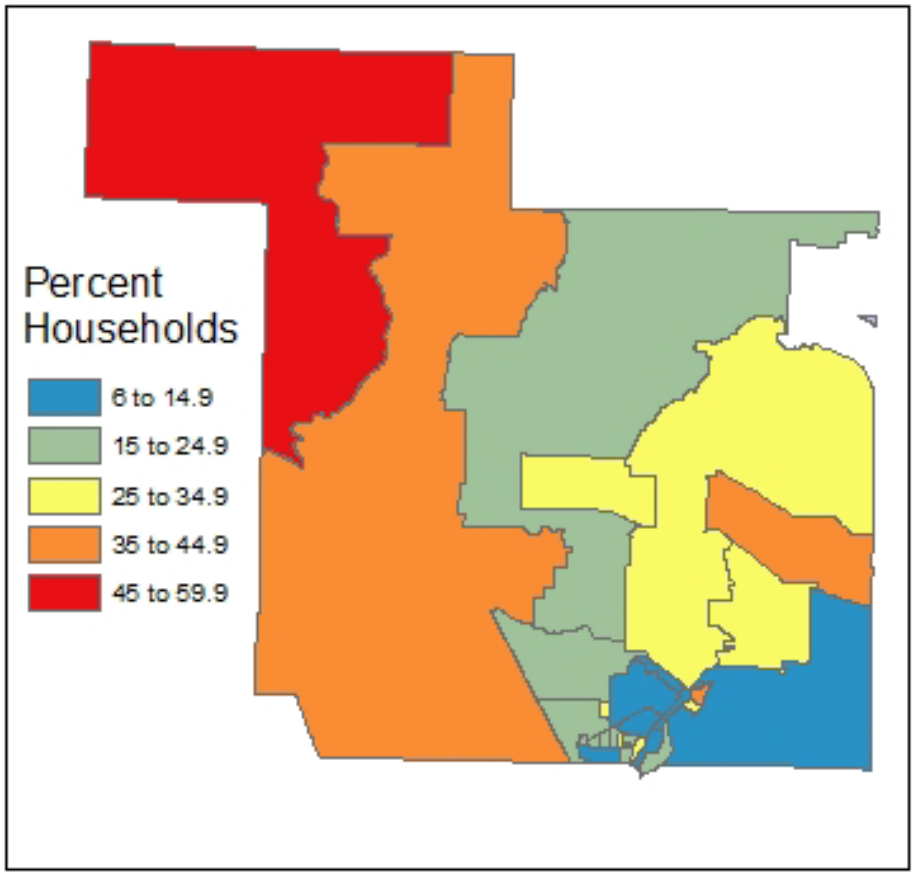


Figure 12. Percent households by census tract in Sandoval County making less than half the county's median household income (less than $25,000) (U.S. Census Bureau 2015)

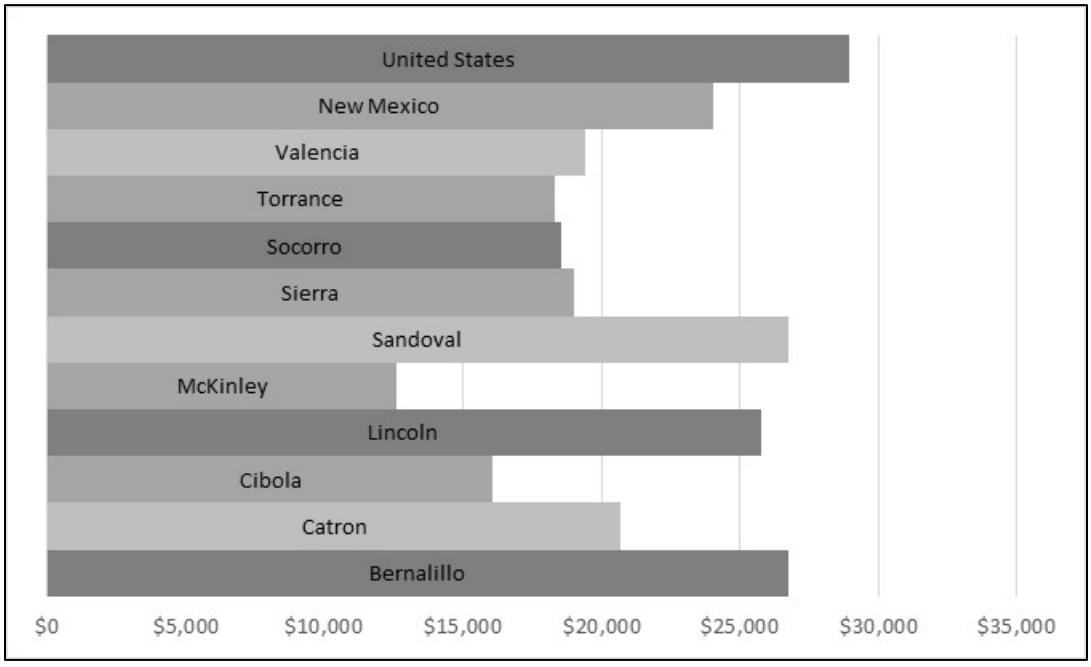


Figure 13. Per capita personal income, 2015 (U.S. Census Bureau 2016a)

Non-Labor Income

Non-labor income is income that is received from sources other than wages, salary, or net income from self-employment. These include social security, retirement income, pensions, survivor benefits, disability payments, food stamps, cash public assistance, etc. Communities with an older population typically receive a significant portion of their income from social security and retirement sources. Communities that receive a large portion of their income from food stamps or other public assistance programs indicate high levels of economic hardship. Figure 14 details the percent of households receiving labor earnings and non-labor earnings by source.

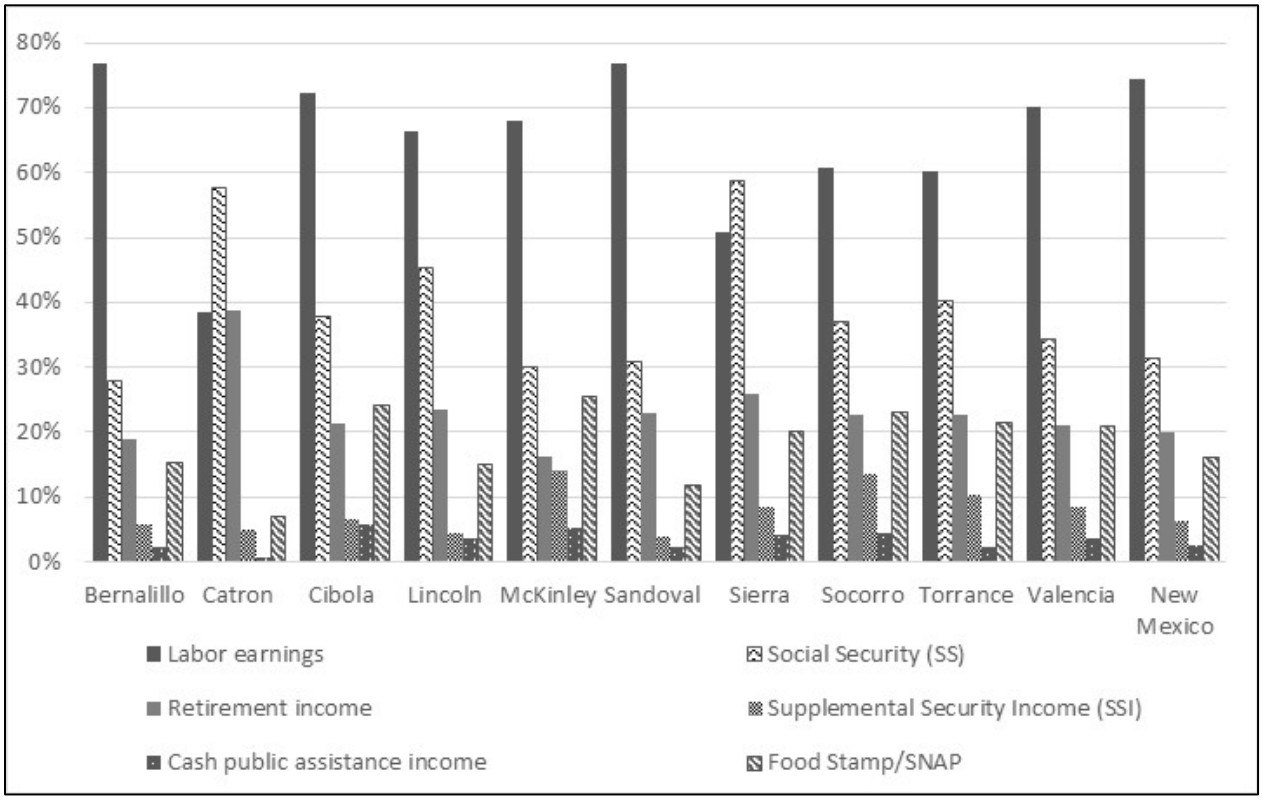


Figure 14. Percent of households receiving earnings, by source, 2015 (U.S. Census Bureau 2016a)

Fifty-eight percent of households in Catron County in the planning area receive their income from Social Security (58 percent) and 39 percent receive retirement income. Only 38 percent of households receive income from labor earnings. Only 51 percent of households in Sierra County receive income from labor earnings (Census Bureau 2016). In contrast, over 77 percent of households in Bernalillo County receive income from labor earnings, as does the United States as a whole.

Cibola, McKinley, Sierra, Socorro, Torrance, and Valencia all have per capita incomes below $20,000 (see figure 14). These counties also have higher percentages of households receiving food stamps or supplemental nutrition assistance. As shown in figure 14, at least 20 percent of households receive nutrition assistance in these counties. For reference, 16 percent of New Mexico households, and 13 percent of U.S. households receive food stamps or supplemental nutrition assistance. However, only Cibola, Sierra, and Socorro Counties receive cash public assistance at rates higher than either state or national averages, by about 2 to 3 percent (U.S. Census Bureau 2016a).

Despite being counties with a younger population, on average, 14 percent of households in McKinley and Socorro Counties receive income from supplemental security income; which is for individuals who are 65 or older, blind, or disabled and have limited income and resources. In comparison, only 5.4 percent of U.S. households and 6.2 percent of New Mexico households receive supplemental security income.

Poverty

Poverty is an important indicator of both economic and social well-being. Individuals with low incomes are more vulnerable to a number of hardships, which may negatively affect their health, cognitive development, emotional well-being, and school achievement. Following the Office of Management and Budget's directive 14, the Census Bureau uses a set of income thresholds that vary by family size and composition to detect who is poor. If the total income for a family or an individual falls below the relevant poverty threshold, then the household members are classified as being below the poverty level.

Poverty levels in the United States, New Mexico, and the planning area in 2015 are nearly identical to their 1989 levels (figure 15). Very little improvement was seen until 2000 and 2004 (for a few counties), when poverty levels dipped to their lowest levels, before rising once again during the Great Recession (U.S. Bureau of Economic Analysis 2017).

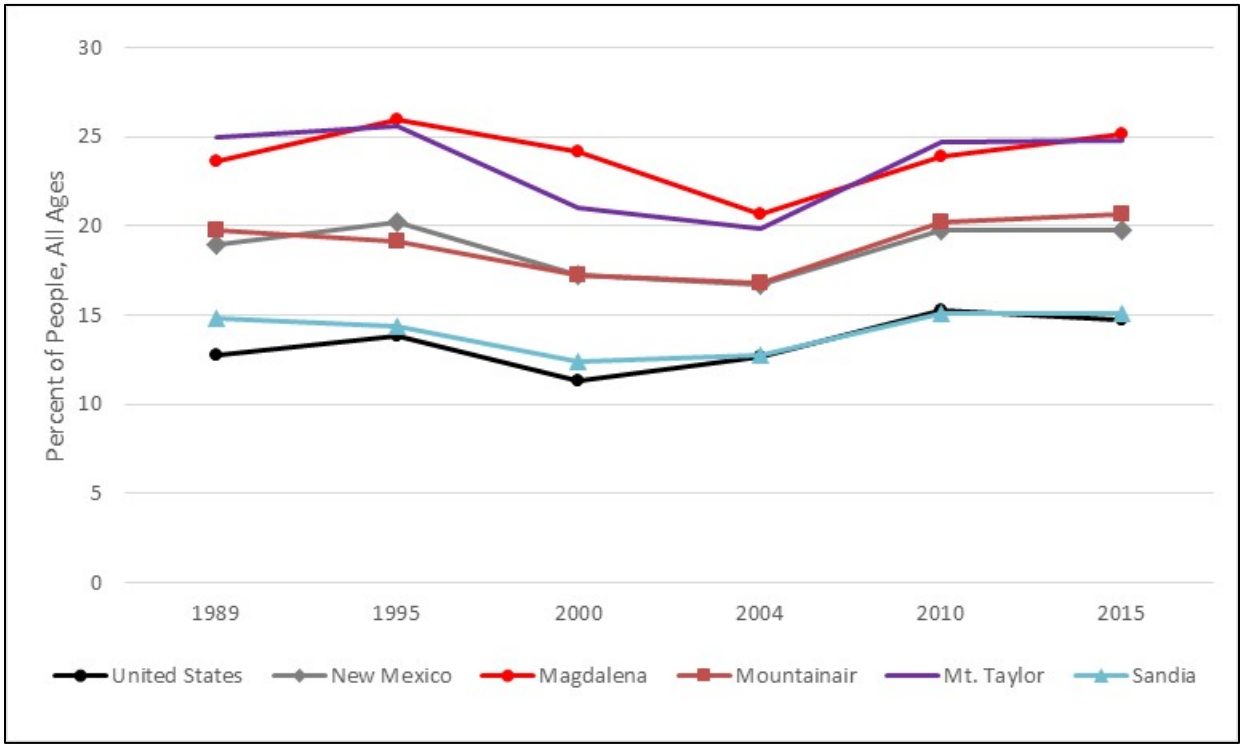


Figure 15. Percent of people living in poverty, all ages, 1989-2015 (U.S. Bureau of Economic Analysis 2017)

Poverty levels in the planning area range from 15 to 25 percent of the population. Sandia Ranger District has a poverty rate on par with the United States. However, the Sandia Ranger District contains Bernalillo and Sandoval Counties, both with large populations near or within the greater Albuquerque area. This indicates the data is not necessarily representative of the rural communities surrounding the Cibola National Forest. Mountainair Ranger District has a poverty level similar to New Mexico's, but 5 percent above the United States average. Magdalena and Mt. Taylor Ranger Districts have poverty levels nearly 10 percent higher than the United States and 5 percent higher than New Mexico.

The poverty level in the Mt. Taylor Ranger District can be misleading because it includes Sandoval County, which has a large population and high per-capita incomes. If Sandoval County were excluded from Mt. Taylor's average, the poverty rate would be 32 percent in 2015, on average 5 percent higher than when Sandoval County is included.

Poverty in figure 15 is reported in aggregate, which may mask important details about who is living in poverty. For example, even though only 11 percent of the planning area's population is American Indian, they account for 21 percent of total poverty (U.S. Census Bureau 2016a). As previously discussed, the planning area has a high percentage (44 percent) of Hispanic or Latino (of any race); however, they account for an even higher portion, 51 percent, of total poverty (U.S. Census 2016a). In contrast, non-Hispanic or Latino White make up 39 percent of the study area population and only 24 percent of the population below poverty.

Forest Economic Contributions

The role of the Cibola National Forest in the regional economy was modeled with IMPLAN Professional 3.0 software using 2016 data. IMPLAN is an input-output model, which estimates the economic consequences of activities, projects, and policies on a region. Input-output analysis represents linkages between sectors in an economy. For example, forest visitors spend money on accommodation and food. Accommodation and food service businesses buy supplies from other businesses. The employees of these firms spend their earnings on a variety of goods and services. These transactions result in direct, indirect, and induced effects in the regional economy, respectively.

IMPLAN uses Forest Service data on expenditures and resource uses to estimate the economic consequences of Cibola National Forest management. In most cases, quantitative inputs (for example, animal unit months, recreation visits, and Forest Service payments to counties) were averaged for fiscal year 2014 to fiscal year 2016 to lessen the effect of annual fluctuations.

Market transactions attributable to activities on the Cibola National Forest support an estimated 1,276 jobs and $48.7 million in labor income in the regional economy (table 72). Forest Service activities on the Cibola are responsible for approximately 0.2 percent of total employment and 0.17 percent of labor income in the 10-county area. The Cibola contributes the most employment and labor income to the government, agriculture sectors, and accommodation and food services. The agriculture sector is the most reliant on Forest Service activities. Approximately 2 percent of employment and 4 percent of labor income in the agriculture sector is attributable to activities on the Cibola. The agriculture sector includes both grazing and forestry, so the relative importance of Forest Service activities in this sector is expected.

Jobs in IMPLAN (table 72) are the annual averages of monthly jobs in each industry. A job can be either full time or part time; the job estimates are not full-time equivalents. Labor income (table 73) includes employee compensation and proprietors' income—the wages, salaries, and benefits paid to employees and self-employed individuals.

The discrepancy between the relative contribution of the Cibola National Forest to employment and labor income (0.23 percent of regional employment versus 0.18 percent of regional labor income) indicates jobs related to Cibola National Forest activities pay less than jobs not related to those activities. The high concentration of Cibola-related jobs in the retail trade, accommodation and food services, and agriculture sectors is consistent with the discrepancy. Many jobs in these industries use low-skilled labor, part-time labor, or both.

Table 74 displays the economic contribution of Cibola National Forest activities by program area. Recreation and Forest Service expenditures contribute the most to employment in the regional economy on average annual basis. The labor income data show differences in income per job by program area. For instance, while each recreation-related job provides approximately $28,000 in labor income, Forest Service expenditures provide approximately $54,000 in labor income per job. These findings reveal that jobs supported by Forest Service expenditures pay well compared to jobs supported by recreation activities on the Cibola National Forest. Recreation-related employment is more likely to be seasonal, which contributes to the lower earnings.

There is no commercial production of minerals on the Cibola. Personal use permits for landscape rock are issued each year. Therefore, mineral activities on the Cibola National Forest do not have measureable economic impacts in the region.

The above analysis considers only the market transactions that result from activities on the Cibola National Forest. Numerous nonmarket social and economic values are associated with the Cibola. The value of ecosystem services, such as, clean air and water, are not captured in the economic contribution analysis. Therefore, this analysis is not a representation of the total economic value of the Cibola National Forest. Ecosystem services are addressed in the "Designated Areas" section.

Table 72. Employment contribution of the Cibola National Forest to the regional economy, 2016

Sector	Area Totals	Forest Service Related
Agriculture	9,679	177
Mining	2,726	3
Utilities	1,553	2
Construction	31,521	10
Manufacturing	20,184	19
Wholesale trade	17,743	30
Transportation and warehousing	55,834	19
Retail Trade	11,967	129
Information	10,734	6
Finance and insurance	20,981	18
Real estate, rental, and leasing	21,546	23
Professional, scientific, and technical services	49,313	59
Management of companies	4,050	5
Administrative, waste management, and remediation services	32,873	27
Educational services	9,562	16
Health care and social assistance	70,899	48
Arts, entertainment, and recreation	12,549	37
Accommodation and food services	48,714	197
Other services	31,507	29
Government	100,352	249
Total	564,286	1,102
Forest Service as percent of total	NA	0.20%

Table 73. Labor income contribution (in thousands of 2016 dollars) of the Cibola National Forest to the regional economy, 2016

Sector	Area Totals	Forest Service Related
Agriculture	$96,854	$4,725
Mining	$96,779	$92
Utilities	$167,673	$207
Construction	$1,461,273	$505
Manufacturing	$1,112,655	$669
Wholesale trade	$908,992	$1,999
Transportation and warehousing	$1,674,168	$1,308
Retail trade	$683,533	$3,727
Information	$677,349	$374
Finance and insurance	$1,093,836	$1,101
Real estate, rental, and leasing	$436,971	$564
Professional, scientific, and technical services	$3,635,537	$2,577
Management of companies	$193,636	$254
Administrative, waste management, and remediation services	$1,167,335	$1,029
Educational services	$288,452	$445
Health care and social assistance	$3,441,172	$2,725
Arts, entertainment, and recreation	$152,686	$538
Accommodation and food services	$1,064,967	$4,415
Other services	$1,250,952	$1,416
Government	$7,041,236	$16,892
Total	$26,646,054	$45,561
Forest Service as percent of total	NA	0.17%

Source: Forest-Service-generated estimates using MIG, 2016.

Table 74. Contribution of the Cibola National Forest by program area

Program Area	Employment	Labor Income (Thousands in 2016 Dollars)
Recreation	398	$11,153
Grazing	260	$4,853
Timber	145	$7,731
Minerals	0	$0
Payments to counties	87	$4,132
Forest Service expenditures	386	$20,929
Total	1,276	$48,798

Source: Forest-Service-generated estimates using Minnesota IMPLAN Group, 2016.

Other Key Forest Contributions

Changing Economies

Cibola National Forest recognizes its role in the supporting the local economy, both through commodity production, including timber and other multiple-use products but also the service-based economy that includes recreation and tourism. Recreation and tourism are important roles of all national forests, including the Cibola due to its proximity to large urban centers and its wealth of culturally and historically significant sites.

Land Use Conversion

Areas characterized as having high levels of natural amenities (distinctive land and water features, mild temperatures, scenic quality, and recreation opportunities of a geographic region) have been shown to experience greater population growth than areas with fewer natural amenities, and this growth occurs increasingly at the boundaries of public lands (Rasker and Hansen 2000, Radeloff et al. 2001). In recent years, residential development has increased adjacent to Cibola National Forest boundaries. This is likely because of proximity to open spaces and natural settings, which provide residents with easy access to recreational opportunities year round. Correspondingly, there has been a trend of increased recreational use on all Cibola National Forest ranger districts.

Over the past five decades, urbanization has continuously encroached on wild lands adjacent to developed areas, such as in the Albuquerque area. Economic and social factors, such as discretionary income levels, decisions about where to live, and available transportation, combine to deplete undeveloped land and change land uses. As land shifts from forest and agriculture to developed uses, the ecological benefits that nature provides are diminished. The linkages between the Cibola National Forest and the well-being of people are as important as they ever were, but they are less visible and less of a concern for most of us in our everyday lives. These changes, in turn, influence the political debate surrounding forest management (USDA Forest Service 2011f).

The Sandia Ranger District faces tremendous customer service and urban sprawl challenges in managing the Sandia and Manzanita Mountains. The real estate industry and home buyers have long recognized the desirability of building a primary or second home residence next to the Cibola National Forest boundaries. Loss of access to the Cibola National Forest has occurred because many private landowners do not allow public access across their property to National Forest System lands, and new landowners are often reluctant to allow public access across their property (USDA Forest Service 2015b).

Development of residential areas near the national forest boundaries frequently influences fire suppression strategies within the boundary, to protect property and lives should a wildland fire move off of the Cibola. As of 2010, approximately 14 percent (31 square miles) of all wildland-urban interface[41] lands in the 10-county study area contained residential properties (Headwater Economics 2017). Bernalillo, Sandoval, and Lincoln Counties had the highest portion and total square miles of developed wildland-urban interface. This translates into demands by the public for increased efforts by the Cibola to manage fuels and fire and suppress wildfire in these interface areas to protect private properties.

As part of the effort to respond to issues, which arise because of urban sprawl, the Sandia Ranger District has increased its collaboration with surrounding communities in county planning, regional transportation planning, open space designation, and rural economic and tourism development.

[41] Wildland-urban interface is defined as private lands within 500 meters of public forestlands.

Traditional community values are being heavily impacted by urban sprawl, producing many challenges to the Cibola National Forest personnel to manage for a full range of user groups. The forest assessment discusses land conversion and wildland-urban interface and the implications for Cibola and management in more detail (USDA Forest Service 2015b).

Biomass

Sustainable development requires sustainable energy supplies, particularly fuel for transportation and electricity for commercial and residential uses. In the future, the prospects for increasing the Nation's ability to use forest biomass to produce bioenergy and biofuels may result in increased demands and opportunities on forested landscapes. The drive for energy independence and reductions in carbon emissions from combustion of fossil fuels result in the emergence of new forest-based energy industries and increased competition among traditional and new forest products industries.

An example of this development is a forest-based biomass industry developed near Mt. Taylor Ranger District. This local industry developed from a landscape scale restoration of ponderosa-pine-dominated forests in the Zuni Mountains. The Zuni Mountain Collaborative Forest Landscape Restoration Program is a landscape restoration priority for the Cibola National Forest; it is located in the wildland-urban interface. It provides a long-term sustainable supply of wood products to supply local wood utilization businesses and personal permit holders (USDA Forest Service 2013b).

Recommended Wilderness

Wilderness provides multiple values to humans both directly (for example, recreation, subsistence use, scientific benefits) and indirectly through the ecological services it provides (such as watershed protection). However, there are tradeoffs because wilderness designations come with specific management direction and restrictions on human use. For example, designation of wilderness, research natural areas, and some special management areas can restrict certain activities from occurring, such as forest product harvesting or firewood cutting, road building, certain fire suppression or fuel management activities, or energy development.

The assessment discusses a review of a number of studies of the economic contribution associated with wilderness and designated areas (USDA Forest Service 2015b). Most research regarding wilderness and designated area quantify the nonmarket benefits, or the benefits that are more difficult to value in a traditional marketplace. Cordell et al. (2005) and Loomis and Richardson (2001) outline these wilderness benefits as recreation, community (for example, subsistence use and jobs), scientific (for example, research and education), off-site (for example, scenic viewsheds), biodiversity, ecological services (for example, watershed protection), and passive use (for example, option to visit an area in the future or conserving wildlands for future generations). In contrast, one study looked at the differences in the economic conditions of wilderness and nonwilderness counties and found that while some wilderness can have positive economic impacts, there was a significant negative relationship between the presence of wilderness and county total payroll, county tax receipts, and county average household income (USDA Forest Service 2015b).

Cultural Uses and Values

The Cibola has a rich history of people connected to this ancient landscape. We recognize that American Indians, Hispanic land grant heirs, and residents of contemporary communities are here because of the land and the value they place on it.

Seventeen federally recognized tribes consider the Cibola National Forest as part of their ancestral territory and acknowledge contemporary traditional uses on these lands. Geologic features and specific places on the landscape have significance due to their endurance over time. Historical narrative rooted in the context of place link generations between the past and the present (Ball 2000). Native history is described through geographic connections rather than as sequential and temporal (Deloria 1994). For Native American populations, the land is not only the foundation of religious belief and historical context through which belief systems are transferred across generations, it also provides nonmarket benefits through provisioning of ecosystem services.

Federally recognized tribes rely on the ecosystem services of the Cibola including, but not limited to, water for domestic, agricultural, and ceremonial uses; fuelwood and other forest products for personal, commercial, and ceremonial uses; and opportunities for visitation and resource collection in areas with long-standing cultural uses. The key threats to sustaining tribal cultural uses and values include changes in land ownership, degradation of forest health and watershed conditions, changing technologies and energy development, population growth, urban pressures and expanding recreation use, and the development of private lands.

In addition to the traditional cultural uses of the region's many tribes, rural historic communities (including Hispanic land grants-*mercedes* communities, acequias associations, and central New Mexico historic communities) also have important historic and contemporary uses to consider given their long established connections to the Cibola National Forest. As described in the draft land management plan, these historic communities were founded during different historical eras predating the establishment of the national forest. They were created and organized around different purposes, which continue to define their demographic composition and how the communities are organized to manage and advocate for shared resources and interests.

The Hispanic land-grant communities and acequias associations were organized around shared lands and resources that are either now directly controlled or indirectly affected by National Forest System land management. Resources provided by lands common to these communities include grazing land, stone and clay, wood, game, fish, medicinal plants, water for agriculture and consumption, and other forest products. The central New Mexico historic communities were founded due in part to the U.S. government's policies to encourage settlement of the West and to meet the demands of a growing Nation. Many people attracted for the economic opportunities were from existing New Mexico communities and other part of the U.S. and the world. The communities and economies that evolved were rooted in their relationship with the land and the commodity values derived from them. While some of these communities have evolved over time to accommodate tourism and the increasing demand for recreation, the more traditional aspects of their identity and economy are grazing, mining, logging, and transportation (railroads, stage lines, and highway networks).

Recreation and leisure opportunities are popular cultural uses provided by the Cibola National Forest. The national visitor use monitoring reports conducted in 2006 and 2011 estimated visitation to the Cibola had increased by 1.6 million visits over the 5-year period. It showed visitation from those who live within 50 miles of the Cibola increased from 50 percent in 2006 to about 70 percent in 2011, whereas about 30 percent of visitors live over 200 miles from the Cibola. While national visitor use monitoring reports visitation at the Cibola level, it is thought that much of the increase in visitors results from the growing urban population of Albuquerque as illustrated by the growing populations of Bernalillo and Sandoval Counties which are associated with the Sandia Ranger District.

The more popular activities reported in the national visitor use monitoring include hiking and walking, viewing natural features, bicycling, driving for pleasure, relaxing, viewing wildlife, picnicking, hunting, downhill skiing and nature center activities. It is important to note people's preferences for outdoor recreation activities change over time. What people choose to do now for outdoor recreation is noticeably different from choices made by, and available to, previous generations of Americans (Cordell 2008 and 2012). For instance, motorized vehicle use (for example, 4-wheel drive, all-terrain vehicles, and motor bikes) has increased across the Cibola. Participants in the values, attitudes and beliefs discussion in 2005 repeatedly expressed concerns about the increase in popularity of motorized vehicle use, and the importance of providing nonmotorized opportunities both within wilderness and outside wilderness areas (USDA Forest Service 2005). Mountain biking is another recreational activity that has grown in popularity, most notably on the Mt. Taylor and Sandia Ranger Districts over the past 30 years. Cultural tourism is an important component of the economy of the plan area. According to the 2016 national visitor use monitoring report, roughly a third of those coming to the Cibola visited a museum or visitor center. Tourists are attracted by the nature and significance of historic properties and by the character of traditional communities, a character maintained by the resources and uses of the plan area.

Environmental Justice

In 1994, President Clinton issued Executive Order 12898. This order directs Federal agencies to focus attention on the human health and environmental conditions in minority and low-income communities. The purpose of Executive Order 12898 is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations.

Environmental justice is the fair treatment and meaningful involvement of people of all races, cultures, and incomes, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The goal of environmental justice is for Federal agency decision makers to identify impacts that are disproportionately high and adverse with respect to minority and low-income populations and identify alternatives that would avoid or mitigate those impacts. Environmental justice, minority, minority population, low-income population, and human health and environmental effects are defined in the glossary.

The emphasis of environmental justice is on health effects, benefits, or both of a healthy environment. The Council on Environmental Quality (CEQ) has interpreted health effects with a broad definition: "Such effects may include ecological, cultural, human health, economic or social impacts on minority communities, low-income communities, or Indian Tribes…when those impacts are interrelated to impacts on the natural or physical environment" (Council on Environmental Quality 1997).

As illustrated in the discussion above, poverty levels are generally highest among Hispanic and American Indian populations. Two of the poorest counties in the state of New Mexico are within the Cibola's study area. During 2006 to 2010, poverty rates among Hispanics ranged from 17 percent in Mt. Taylor Ranger District to nearly 30 percent in Magdalena Ranger District. During this same period, one out of every four American Indians lived in poverty in Sandia Ranger District, while almost one of every two American Indians lived in poverty in Magdalena Ranger District.

The environmental consequences analysis under each alternative will addresses the potential for Forest Service actions to disproportionately and adversely affect low-income and minority populations. Because racial and ethnic composition, unemployment, and poverty rates are above the reference population levels, it is possible forest management decisions will affect members of an environmental justice community.

Environmental Consequences

The previous sections assessed past and current social and economic conditions. The following section will consider the potential consequences of alternative management scenarios on the social and economic environment.

Methodology and Assumptions

Data Sources

Economic impacts were modeled using IMPLAN Professional Version 3.0 with 2016 data. Data on use levels under each alternative were collected from the Cibola's resource specialists. In most instances, the precise change is unknown; therefore, the changes are based on the professional expertise of the resource specialists.

Social consequences use the baseline social conditions presented in the "Affected Environment" section, national visitor use monitoring profiles (USDA Forest Service 2011b), and information from the economic and social sustainability assessment (USDA Forest Service 2015b) to discern the primary values the Cibola National Forest provides to area residents and visitors. Social effects are based on the interaction of the identified values with estimated changes to resource availability and uses.

Assumptions

- Some of the value of forest management is not captured in market transactions. Nonmarket goods and services, such as clean air, scenic vistas, opportunities for spiritual renewal, have economic values that are not readily quantifiable in dollar values. Management actions that improve Cibola National Forest health will increase nonmarket values. For the purpose of this analysis, lands with a restoration emphasis will be used as a proxy for nonmarket values.
- Designation of lands as wilderness or in the primitive recreation opportunity spectrum is not expected to change the number of visits, but it is expected to limit the suite of recreation opportunities and management actions that may occur in these areas. Opportunities for motorized or mechanized recreational opportunities would not be provided in these areas.
- The framework for the social analysis employs generalities based on values identified by demographic groups identified in the social and economic assessment. Area residents, tribal members, and Cibola National Forest visitors have diverse preferences and values that may not be fully captured in the description of social consequences. Nevertheless, the general categories are useful for assessing social impacts based on particular forest-related interests.
- The more focused the land management plan is in recognizing and managing for unique features, the greater the likelihood of conserving such values through active management.
- Restoration and conservation management area management would decrease risk to cultural and ecological resources.

Economic Impact Analysis

Economic impact analysis estimates the employment and labor income consequences of forest management actions. The tables presented in this section will be referenced in the alternative-specific descriptions of economic impacts.

Table 75 provides employment estimates, by alternative. Recreation, grazing, and Forest Service expenditures account for the vast majority of Cibola-National-Forest-related employment under all alternatives.

Table 75. Number of jobs contributed by program area, by alternative

Program Area	Alternative A	Alternative B	Alternative C	Alternative D
Recreation	398	398	398	398
Grazing	86	88	88	86
Timber	145	145	179	145
Minerals	0	0	0	0
Payments to states and counties	87	87	90	87
Forest Service expenditures	386	386	386	386
Total	1,102	1,104	1,142	1,102

Source: Minnesota IMPLAN Group 2016

Under all alternatives, employment supported by activities on the Cibola would account for approximately 0.2 percent of area employment. The percent of area employment associated with the Cibola appears particularly small due to the inclusion of Bernalillo County in the study area, which has a very large labor force. The dominance of Bernalillo County may mask the economic importance of the Cibola in other counties, which are much less populous.

Table 76 provides labor income estimates, by alternative. As with the employment estimates, recreation, grazing, and Forest Service expenditures account for the majority of Cibola National Forest contributions to local economic activity.

Table 76. Labor income (in thousands of 2016 dollars) by program area, by alternative

Program Area	Alternative A	Alternative B (modified)	Alternative C	Alternative D
Recreation	$11,153	$11,153	$11,153	$11,153
Grazing	$1,616	$1,649	$1,649	$1,616
Timber	$7,731	$7,731	$9,596	$7,731
Minerals	$0	$0	$0	$0
Payments to states and counties	$4,132	$4,132	$4,303	$4,132
Forest Service expenditures	$20,929	$20,929	$20,929	$20,929
Total	$45,561 ($45.6 million)	$45,595 ($45.6 million)	$47,631 ($47.6 million	$45,561 ($45.6 million)

Source: Minnesota IMPLAN Group 2016

Table 77 provides the estimated annual forest product volumes available, by alternative. These volumes are used to estimate the economic impact of timber-related activities on the Cibola National Forest. This table will be referenced in alternative-specific descriptions of the economic consequences of forest product removal. Alternatives C would provide the highest annual forest product volumes. However, the variation between alternatives in terms of economic consequences is small.

Table 77. Estimated annual forest product volumes, by alternative

Forest Product	Alternative A Annual Volumes	Alternative B Annual Volumes	Alternative C Annual Volumes	Alternative D Annual Volumes
Harvest-softwood sawtimber (CCF)	6,193	6,193	7,431	6,193
Harvest-softwood pulp (CCF)	36	36	43	36
Fuelwood (cords)	9,000 to 12,000	9,000 to 12,000	12,000 to 15,000	9,000 to 12,000
Poles (CCF)	2,515	2,515	3,018	2,515
Posts (CCF)	212	212	254	212

CCF = hundred cubic feet

Grazing is also anticipated to vary across management alternatives (see list below). These changes in animal unit months are used to estimate the economic impact of grazing-related activities on the Cibola. Alternatives B and C would provide the highest annual utilization—a two percent increase over alternative A. The variation between alternatives in terms of economic consequences is also small.

- Alternative A annual authorized: 33,309 cattle, horse, or mule animal unit months
- Alternative B annual authorized: 33,996 cattle, horse, or mule animal unit months
- Alternative C annual authorized: 33,996 cattle, horse, or mule animal unit months
- Alternative D annual authorized: 33,309 cattle, horse, or mule animal unit months

Social Consequences

Table 78 lists the plan elements that have associated socio-cultural values that may influence the forest's ability to for manage competing values and meet the needs of the diverse public over the next 15 years.

How the plan elements listed in table 78 influence social and cultural dimensions is described here.

- Wilderness designation - Individuals who value primitive recreation settings and opportunities for solitude use are likely to derive benefit from the recommendation of additional wilderness areas. Trade-offs include restrictions on mechanized and motorized recreation opportunities and limiting opportunities for active restoration. Existing trends on these landscape in respect to ecosystem services in wilderness areas would continue.
- Conservation management areas would continue to provide current motorized recreation opportunities on the currently designated national forest transportation system while also limiting future development of new motorized trails. Mechanized recreation, such as mountain biking would be allowed while maintaining a near natural setting or low level of development and emphasizing active restoration of ecological systems. Ecosystem services would be benefitted through the limitation of new roads and motorized trails coupled with active investments in restoring ecosystem processes.

- Restoration management - Restoring ecological resilience through more intensive restoration than in the conservation management areas and exhibit a greater level of development. Investments in restoration would reduce risks to ecological values and provide an increased flow of nonmarket goods such as fuelwood, water for grazing, traditional plants. Such investments in risk reduction provide consequential investments in conserving the provisioning and regulating ecosystem services necessary to sustain traditional cultural practices.
- Site-specific management areas would provide the specific management direction focusing attention on the distinctive values and features of these areas and emphasizing the values to be conserved and promoted in the context of multiple use management over the life of the plan. The preservation of distinctive values and features through site-specific management areas include areas that emphasize the traditional cultural uses and values supported by the Cibola National Forest.
- Special forest products (Christmas trees, wildings, fuelwood) are indicators of the anticipated flow of traditional cultural products anticipated by alternative that are critical in sustaining cultural practices and may provide supplemental subsistence income for individuals living below the poverty level.

Table 78. Socio-cultural-related values, acres by alternative

Area	Alternative A	Alternative B (modified)	Alternative C	Alternative D
Existing designated wilderness (acres)	138,502	138,502	138,502	138,502
Additional recommended wilderness* (acres)	0	55,533	24,019	203,117
Total wilderness – designated and recommended (acres)	138,502	194,035	162,521	341,619
Conservation management area (acres)	0	0	36,547	0
Restoration management area (acres)	0	0	318,148	0
Site-specific management focus	*Proposed Little Water Canyon Research Natural Area (#14 Management Area)	98,505	0	0
Fuelwood (CCF)	11,520 to 15,360	11,520 to 15,360	15,360 to 19,200	11,520 to 15,360
Christmas tree	827	827	992	827
Wildings	69	69	82	69

Source: Cibola National Forest resource specialists

Economic Impact and Social Consequences

Area residents and visitors attach numerous values to the Cibola National Forest. For some, National Forest System lands provide economic opportunities in rural communities. To others, the Cibola is valued for social and cultural enrichment opportunities. Five core themes evolved from the assessments and public comments submitted through the plan revision process: (1) respecting cultural and traditional landscapes and uses, (2) valuing unique places and features, (3) managing holistically for watershed and ecosystem health, (4) managing for sustainable recreation, and (5) managing risk.

This section is mainly concerned with the effects to second-level ecosystem services. The first level of ecosystem services may be thought of as the raw materials (for example, water or vegetation) that go into providing the second-level ecosystem services (for example, recreation, scenery, and wood fiber). Effects to first-level ecosystem services that will influence the provision of second-level ecosystem services can be found in the "Vegetation"; "Fire and Fuels"; "Watershed Resources"; and "Terrestrial, Aquatic, and Botanical Species" sections. Effects to second-level ecosystem services can be found in the "Traditional Communities and Uses", "Scenic Resources", Recreation", "Special Uses", "Sustainable Forestry and Forest Products", "Sustainable Rangelands and Livestock", "Minerals and Geology", and "Infrastructure" sections.

As described in the affected environment section, ranger districts on the Cibola National Forest are geographically distinct units distributed across the study area and vary in visitor rates and demand for different uses. This suggests Forest Service decisions and other Federal actions may have a differing effects on social and economic well-being in the study area depending on the ranger district and the communities most closely associated with these ranger districts. The main sources of potential variation in social and economic consequences between alternatives are the management approaches informed by management area designations, wilderness designations, and objectives for resource outputs.

Environmental Consequences Common to All Alternatives

Recreation: There are approximately 1.6 million recreation visits to the Cibola National Forest annually; 32 percent of these visits originate outside of the local area. The expenditures of local and non-local visitors to the Cibola would support approximately 398 jobs and $11.2 million in labor income, annually. Recreation visits to the Cibola contribute jobs and income to the local economy under all alternatives.

Minerals: There is no commercial production on the Cibola. Personal use permits for landscape rock are issued each year. The quantities removed are not expected to differ between alternatives. Under all alternatives, mineral activities on the Cibola do not have measurable economic impacts in the region. However, the availability of saleable minerals, would continue to contribute to household wellbeing under all alternatives.

Forest Expenditures: Cibola National Forest salary and non-salary (for example, office equipment) expenditures support approximately 386 jobs and $20.9 million in labor income in the local economy, annually. Forest Service employment and expenditures offers local economic stability in the form of jobs and labor income.

Environmental Consequences Common to Alternatives A, B, and D

Social Consequences: The provision of special forest products, such as Christmas trees, fuelwood and wildings, is projected to be the same among alternatives A, B, and D therefore in respect to supporting traditional cultural values and uses these values would remain constant and in line with the current outputs.

Environmental Consequences – Alternative A

Management actions under alternative A are expected to support 1,102 jobs and approximately $45.6 million in labor income in the local economy.

Indirect Effects

Timber: The average estimated annual forest product volume removal is the same under alternative A as alternative B and D. Based on the forest product removal estimates listed in table 77, forest product removal under alternative A would support 145 jobs and $7.7 million in labor income in the local economy, annually. This is equivalent to the estimated employment and labor income supported by forest product harvesting under alternatives B and D.

Range: An estimated 46,000 animal unit months would be permitted. However, authorized use is lower and would vary based on local forage and market conditions. Authorized utilization is estimated at approximately 33,309 animal unit months. Based on authorized animal unit months, approximately 86 jobs and $1.6 million in labor income are supported by grazing on the Cibola National Forest, annually. This alternative has lower estimated economic contribution than alternative B and C as a result of the lower authorized animal unit months. However, the differences are small, and variation in actual authorized animal unit months may make all alternatives equivalent.

Payments to States and Counties: As noted in the social and economic assessment (USDA Forest Service 2015b), due to the Cibola National Forest payments to local governments are made through two programs. These are the Department of Interior administered payments in lieu of taxes and Forest Service county payments—the Secure Rural Schools Act or the Federal 25 percent fund payments. These payments would support approximately 87 jobs and $4.1 million in labor income annually under alternative A. This is equivalent to alternatives B and D. These payments offers local economic stability in the form of jobs and labor income.

Social Consequences: The plan assessment found many of the ecosystem services that support tribes are declining. This could be, in part, due to stresses that may be affected by national forest land management, including degradation of forest health and watershed conditions affecting plant collections; population growth, urban pressures, and expanding recreation use contributing to conflicts with traditional practitioners; and changing technologies and energy development interfering with traditional ceremonies. Cultural resources are largely intact and stable but are threatened by vandalism and looting, development of the urban interface, and climate change. The no-action alternative would continue these trends by focusing largely on providing commodity outputs rather than restoring ecological processes and the ecosystem services communities are reliant upon.

Alternative A also provides little guidance and direction conserving the unique features and values of the Cibola which may put such features at risk. Cultural tourism, which is described in the social and economic assessment as a significant component of the plan area economy, is reliant upon the historic and contemporary cultural resources being maintained. Alternative A has the least emphasis of all the alternatives on recognizing and maintaining these cultural assets and the economic sectors dependent on them. Existing risks to the provision of ecosystem services that support local and regional communities will continue, thereby putting traditional cultural values and uses at risk and providing little support to conserve unique features and values.

The no-action alternative offers the smallest amount of primitive recreation opportunities in wilderness areas. It also offers the greatest amount of semi-primitive motorized and semi-primitive nonmotorized recreation opportunities for recreationists who prefer off-highway vehicle riding or mountain biking (see the "Recreation" section for more information). The social and economic assessment had noted encroachment by cyclist in the existing wilderness areas adjacent to Albuquerque. These trends are likely to continue under alternative A, posing risks to the designated wilderness values in these areas.

Environmental Consequences – Alternative B

Management actions under alternative B are expected to support 1,104 jobs and approximately $45.6 million in labor income in the local economy.

Indirect Effects

Timber: The average estimated annual forest product volume removal is the same under alternative B as alternative A and D. Based on the forest product removal estimates listed in table 77, forest product removal under alternative A would support 145 jobs and $7.7 million in labor income in the local economy, annually. This is equivalent to the estimated employment and labor income supported by forest product harvesting under alternatives A and D.

Range: Approximately 46,000 animal unit months would be permitted. However, authorized use would vary based on local forage and market conditions. Under this alternative utilization is estimated to increase by two percent, or approximately 2,000 animal unit months, due to the management direction for communal grazing (see the "Sustainable Rangelands and Livestock Grazing" section). Based on authorized animal unit months, approximately 88 jobs and $1.6 million in labor income are supported by grazing on the Cibola, annually. This is a nominal estimated increase over alternatives A and D; however, variation in actual authorized animal unit months may make the range-related economic impacts from all alternatives equivalent. In addition, improvements to landscape conditions could facilitate increases in utilization over time.

Payments to States and Counties: As noted in the social and economic assessment, the Cibola personnel make payments to local governments through two programs: Federal payments in lieu of taxes and Forest Service county payments—the Secure Rural Schools Act or the Federal 25-percent-fund payments. These payments would support approximately 87 jobs and $4.1 million in labor income annually under alternative B. This is equivalent to alternatives A and D. These payments offers local economic stability in the form of jobs and labor income.

Social Consequences: Alternative B emphasizes site-specific management over that of the no-action alternative. Alternative B identifies site-specific features and values to conserve and restore through the management area approaches. Under alternative B, traditional cultural uses and the associated communities would benefit from the designation of the Las Huertas Canyon and Mount Taylor. However, while alternative B is highly focused on conserving unique values and features of the plan area, it does not emphasize landscape-scale intensive restoration as is proposed in alternative C. Market values derived from alternative B are expected to be in line with those generated under alternatives A and D. However, the focus on conserving unique features and values may positively influence the conservation of these values and the perpetuation of cultural-tourism-related revenues.

Alternative B also provides for roughly 55,000 more acres of wilderness designated lands than alternative A. While this would continue to provide more opportunities for nonmotorized recreation opportunities in a primitive setting than alternative A, it also continues to provide opportunities for popular recreation activities such as mountain biking and motorized recreation in areas with lower levels of development contributing to the diversity of recreation opportunities provided on the Cibola National Forest.

Environmental Consequences – Alternative C

Management actions under alternative C are expected to support 1,142 jobs and approximately $47.6 million in labor income in the local economy. This alternative has the highest economic impact, although the increase, in terms of measurable economic consequences is small.

Indirect Effects

Timber: The average estimated annual forest product volume removal is the highest under alternative C. Based on the forest product removal estimates listed in table 77, forest product removal under alternative C would support 179 jobs and $9.6 million in labor income in the local economy, annually. This alternative has the highest economic contribution as a result of the highest timber product removal.

Range: Approximately 46,000 h animal unit months would be permitted. However, authorized use would vary based on local forage and market conditions. Utilization is estimated to increase by two percent, or approximately 2,000 animal unit months, compared to alternative A due to the plan direction for consideration of reopening historically closed grazing allotments. Based on authorized animal unit months, approximately 88 jobs and $1.6 million in labor income would be supported by grazing on the Cibola, annually. This is a nominal estimated increase over alternatives A and D; however, variation in actual authorized animal unit months may make the range-related economic impacts from all alternatives equivalent. The emphasis on partnerships in this alternative should facilitate deferred maintenance of existing range projects and the development of new range projects. In addition, large-scale landscape projects would contribute to the restoration of rangelands. This could result in significant increases in range utilization over time beyond the estimated effects reported.

Payments to States and Counties: As noted in the social and economic assessment (USDA Forest Service 2015b), the Cibola personnel make payments to local governments through two programs: Federal payments in lieu of taxes and Forest Service county payments—the Secure Rural Schools Act or the Federal 25-percent-fund payments. Due to increased timber activity 25 percent program payments to counties are estimated to increase. At the higher level under alternative C, these payments would support approximately 90 jobs and $4.3 million in labor income annually. This is higher than alternatives A, B and D, although in practice the difference is not meaningfully different. These payments offers local economic stability in the form of jobs and labor income.

Social Consequences: Alternative C emphasizes active management and restoration of ecological processes through the designation of 318,148 acres of the restoration management area lands. This alternative provides the greatest level of investment in risk management in terms of pursuing vegetation and fuels management projects that will reduce risk to historic resources and contemporary cultural use areas. The recommended wilderness areas would further to contribute to the benefits and services sustained by existing wilderness through recommending only lands contiguous to wilderness recommended through the wilderness evaluation process.

While alternative C would provide the greatest amount of lands available to active management to reduce risks, it would limit new impacts associated with motorized use and emphasize backcountry primitive recreation through the designation of 36,547 acres of conservation management area. This alternative is anticipated to provide the greatest benefit to ecological conditions and thereby the greatest contribution to providing a sustainable supply of secondary ecosystem services.

The intensive focus on restoration makes alternative C the only alternative that would increase nonmarket economic benefits as indicated by the expected increase in special forest products, such as firewood, Christmas trees, and wildings to support contemporary cultural uses of areas residents and Tribes.

Environmental Consequences – Alternative D

Management actions under alternative D are expected to support 1,102 jobs and approximately $45.6 million in labor income in the local economy.

Indirect Effects

Timber: The average estimated annual forest product volume removal is the same under alternative D as alternatives A and B. Based on the forest product removal estimates listed in table 77, forest product removal under alternative D would support 145 jobs and $7.7 million in labor income in the local economy, annually. This is equivalent to the estimated employment and labor income supported by forest product harvesting under alternatives A and D.

Range: Permitted and authorized use under alternative D is the same as alternative A. Based on authorized animal unit months, approximately 86 jobs and $1.6 million in labor income are supported by grazing on the Cibola National Forest, annually.

Payments to States and Counties: As noted in the social and economic assessment (U.S. Forest Service, 2015), the Cibola makes payments to local governments through two programs: Federal payments in lieu of taxes and Forest Service county payments—the Secure Rural Schools Act or the Federal 25-percent-fund payments. These payments would support approximately 87 jobs and $4.1 million in labor income annually under alternative D. This is equivalent to alternatives A and B. These payments offers local economic stability in the form of jobs and labor income.

Social Consequences: Alternative D emphasizes primitive recreation values through the designation of approximately 200,000 more acres of wilderness. Alternative D would provide the greatest amount of primitive recreation opportunities, while reducing opportunities for mechanized and motorized recreation opportunities in comparison to alternative A. This management emphasis is expected to decrease the risk of introduction of new threats to lands designated as wilderness by eliminating motorized travel and mechanized recreation; these two activities can spread invasive weeds and cause erosion (USDA Forest Service 2015b). A limited suite of management activities to mitigate existing threats to ecological values in lands designated as wilderness would be allowed.

The lands outside wilderness would allow motorized and nonmotorized recreation opportunities. The restoration actions would be approached through the lens of forestwide management direction which would utilize wildfire and prescribed fire as well as vegetation thinning treatments to reduce risks to ecosystem services. Alternative D would provide nominal benefits in improving ecological conditions and ecosystem services when compared with alternative C's intensive restoration approach.

Alternative D, while designating the greatest amount of wilderness, does not emphasize distinctive features or values in the management area design in respect to identifying and managing for specific values related to a place nor does it designate communal grazing areas. Communities reliant on contemporary cultural uses would be nominally benefitted by alternative D in comparison to alternative A through the slight improvement of ecosystem services.

Environmental Justice

American Indian Tribes who consider Cibola National Forest lands within their aboriginal territory, Hispanic land grant communities, and low-income communities indirectly affected by the management of National Forest System lands would derive the greatest benefit from the implementation of alternative C. Affected tribes have geographically specific cultural interests in places located on the Cibola National Forest such as spiritual sites, plant collection areas, and hunting grounds. Hispanic land grant communities have a historical and continued cultural reliance on subsistence values derived from these lands. There is also a higher incidence of poverty for native and Hispanic populations, making subsistence values even more critical in providing supplemental income to mitigate the economic disparity at the individual and household level.

Alternative C provides the greatest benefit for sustaining the flow of secondary ecosystem services that are of vital importance to the maintenance of the cultural practices. Tribes dependent on access to culturally important game, plants, and wood fiber for food, medicine, and ceremonial purposes derived in part from ecosystem services flowing from the Cibola National Forest would be best served through the investment in the restoration of ecological processes under alternative C. A tradeoff of the aggressive restoration approach pursued under alternative C is that this alternative recommends the least amount of wilderness, which would offer the most acres of lands managed for the primitive recreation setting where opportunities for solitude are a defining feature. Opportunities for solitude have been identified as of high importance for ceremonial practices for American Indian tribes. However, pursuant to the provisions under the Food, Conservation, and Energy Act (Farm Bill) of 2008, tribes may pursue area closures for traditional cultural practices under all alternatives, mitigating the distinct advantage of alternative D in providing for privacy for ceremonial practices, which recommends the largest acreage of wilderness designation.

Alternative B provides site-specific management area direction, which includes culturally significant resources for American Indian tribes and Hispanic land grant communities. The designation of five management areas recognize the primary importance to contemporary cultural uses and include desired condition statements reflecting the desire to provide ecosystem system services to support contemporary cultural uses of the tribes and Hispanic land grant communities. The management area approach for the Las Huertas Canyon Management Area emphasizes consultation with affected tribes and coordination with Hispanic land grant liaisons when planning for the protection and enhancement of these lands. The management area direction for the Mount Taylor area limits the expansion of existing communication sites and does not provide for the designation of new communication sites in the management area. It also emphasizes the need to balance recreation demands with traditional uses and recognizes the need to consult with tribes when permitting special use events.

Alternatives A, C, and D do not offer any special recognition or management approaches that recognize the cultural importance of the resources and features in the Mt. Taylor and Las Huertas Canyon Management Areas; however, forestwide direction provides desired condition, objectives and management approaches to collaborate with tribes and traditional communities on the management of culturally significant places.

Alternative C is the only alternative expected to increase the supply of nonmarket economic benefits related to firewood, plant gathering, and hunting. Nonmarket benefits, such as personal firewood collection for heating homes, hunting wild game for personal consumption, or collecting household building materials such as clay or vigas, may reduce the cash burden on households and in this sense provide supplemental household income for individuals living in poverty or in economically depressed rural areas.

Alternative D provides the greatest benefits related to opportunities for solitude, without seeking provisions afforded by the Farm Bill of 2008, by maximizing wilderness designation. While alternative D would contribute to the improvement of ecological conditions and the ecosystem services traditional communities rely on, it does not improve ecological conditions to the extent alternative C does. Alternative A poses the highest level of risk to minority and low-income communities by providing limited contributions to nonmarket and market values and providing little emphasis on restoring ecological resilience and the ecosystem services derived from them. On balance, alternative C provides the greatest benefit to minority and low-income communities.

Cumulative Environmental Consequences

Sandoval County is encompassed among the Mt. Taylor and the Mountainair Ranger Districts. It has the fastest-growing population, which is projected to increase by 26 percent by 2030. The largest population center is Bernalillo County; it is coincident with the Mountainair and the Sandia Ranger Districts. The Sandia Ranger District, followed closely by the Mt. Taylor Ranger District, is projected to have the largest populations in 2030 of the 10-county planning area.

Given the proximity of National Forest System lands to densely populated urban lands, recreational use and related pressures are expected grow on the Sandia Ranger District and portions of the Mt. Taylor and Mountainair Ranger Districts. High recreational use may have unintended consequences and pose an increased risk to other social and cultural values associated with the National Forest System lands. Native plant communities may be affected by the spread of noxious weeds along roads and trails or crushing of plants through the development of nonsystem or user-created trails. Watershed health may be compromised by compaction of soils near streams and trampling of riparian plants, firewood collection, and solid waste contamination of streams. Opportunities for solitude may be diminished, and opportunities to practice cultural and spiritual practices may be compromised. Unique features (geologic features, historic and prehistoric artifacts) would be at risk for defacement or vandalism.

Given the site-specific management and restoration emphasis of alternative C, it is expected this alternative would provide the greatest suite of management tools and guidance on critical values to conserve in these areas when compared to the no-action alternative and alternatives B and D.

Land Ownership Adjustment and Boundary Management

Affected Environment

The Cibola National Forest spans 10 counties and encompasses more than 2.1 million acres, with 1.6 million acres administered by Forest Service personnel and over 491,000 acres in other ownership within its boundaries. Many of the other ownership areas are small towns and communities, but a large number are small parcels of privately owned lands. In addition, much of the national forest boundary adjoins State, Bureau of Land Management, land grants, and tribal lands. Multiple land transactions have occurred within the Cibola National Forest. Over the past 20 years, there have been more than 15 transactions, including purchases of 1,280 acres in 2009 and 1,094 acres in 2014.

Lands-related activities include, without limitation, land exchanges, purchases, and boundary management. Special uses activities include nonpermanent authorizations to use National Forest System lands for non-Federal uses, including utility corridors, private and public roadways, communications sites, or signs.

The land surveying and boundary management program staff marked close to 12 percent of the Cibola National Forest boundaries but lost close to 30 percent of that property boundary marking due to a variety of factors. The remaining 58 percent of property line has not been established.

Lands acquired from willing sellers have qualities that improve the agency's ability to carry out its mission on National Forest System lands and improve land management. The location or condition of the parcel being acquired may contribute to the consolidation of the ownership pattern of the Cibola National Forest, provide necessary road or trail access to National Forest System lands, have unique or high-quality natural or cultural resources, improve the management or designated special areas, contain important plant or animal habitat, contain or influence wetlands or flood plains, or provide opportunities to rehabilitate or stabilize adjacent National Forest System lands. The Forest Service may acquire lands through exchange, purchase, or donation. Land exchange and land purchase have been, and would continue to be, the means by which Cibola National Forest staff acquire key wildland resources and open space areas. Most Federal lands exchanged are within or near existing communities. Most land conveyed to the Cibola National Forest is located in more remote areas. Procedures for processing cases and public participation is determined by set policies, rules, and regulations outside the draft land management plan and would apply regardless of the alternative selected.

Most current land surveying activities in the Forest Service are related to meeting flagship national priorities while some activities are still directed to marking and maintenance of property lines and administrative boundary lines. Surveys are necessary to provide visible and legally defensible property lines and help to protect national forests interests and high-quality natural or cultural resources.

Federal ownership is substantial in all 10 counties in the areas of influence of the ranger districts and exceeds the area of private lands in 4 counties. A notable trend of loss of access to the Cibola National Forest has developed as a result of unwillingness of many private landowners to allow public access across their property. Residential development has increased adjacent to many Cibola National Forest boundaries, and adjacent at-risk communities in the wildland-urban interface have responded to the threat of uncharacteristic wildfire by developing community wildfire protection plans.

The existing fragmented landownership pattern within and adjoining the Cibola, combined with rapid population growth and the nature of the noncontiguous sky islands that comprise the Cibola, has resulted in the loss of traditional public access routes, conflicts in land uses within and adjacent to the national forest boundary, higher administrative costs, and unique challenges for forest management.

Some lands of other ownership adjoining the Cibola have national forest characteristics. Acquisition of these lands would protect public access, open space, and scenic resources; reduce ecosystem fragmentation, improve landscape-level management of forest resources, and eliminate the need to encumber the surrounding National Forest System lands with special use authorizations for roads and private infrastructure.

Environmental Consequences

Effects Common to All Alternatives

Criteria for land adjustment cases are similar among all alternatives. The focus of acquiring non-Federal land is on areas with key resource values such as archeological sites, threatened and endangered species habitat, high recreation opportunities or access, special areas, and riparian habitat. Because the land adjustment criteria is similar among all alternatives, potential land adjustments under this consistent criteria would likely be similar for all alternatives. These important resources could be removed or destroyed if private parcels are developed instead of acquired through land adjustment processes. Additionally, National Forest System lands with these types of resources would be retained in Federal ownership under all alternatives.

Due to budgetary constraints, limitations of the plan direction and adjacent private development, the Cibola would increase in acreage at a slower rate throughout the life of the plan. As budget and staffing continues to be limited to complete land acquisition cases, non-Federal lands with important resources could be developed instead of acquired. Non-Federal inholdings within large areas of the national forest could be developed which could result in the following impacts to adjacent forest lands: increased recreational use, new utility corridors, possible changes to forest users' recreational experience (such as impacting opportunities for solitude), and impacts to forest resources like wildlife habitat and scenery.

Other common effects to all alternatives are the limitations of land exchanges. Exchanges can take years to process and are most often at the full expense of the other party, due to lack of funds by the Federal government and the other party often receiving a benefit from the exchange.

Environmental Consequences – Alternative A

Under the no-action alternative (the 1985 plan), the lands and realty management sections are redundant from one management area to another or reiterate direction that comes from the Forest Service manuals and handbooks. The plan identifies specific inholdings for acquisition and tracts of national forest that are suitable for exchange with the goal of land ownership consolidation to improve management efficiency. A number of these properties have been acquired or exchanged, while others have been developed and no longer meet the criteria for lands that are desirable. Parcels of importance would change throughout the life of the plan as resource values are discovered (for example, archaeology resources) and identified, interested parties come forward, or additional species are listed or conditions change. The need to acquire rights-of-way across State and private property is still a concern. As ownership patterns change within the boundaries of the Cibola, access to National Forest System lands will remain an issue.

The 1985 plan includes a list of specific lands for exchange, many of which have not yet have been exchanged. Due to the aforementioned limitations with land exchanges, this would not be the preferred option for acquisitions within the life of the plan. The list has not been modified to keep up with lands adjustments or with changed priorities. Parcels of importance change throughout the life of the plan as resource values are discovered and identified; for example, archaeology resources may be identified, wildlife species may be listed, or conditions may change. The 1985 plan does not account for these types of changes throughout the life of the plan.

Overall, the 1985 plan does not address concerns for community open space values that are now part of most local and county comprehensive land management plans. The 1985 plan identifies a classification system of lands with criteria for land acquisition such as riparian, recreation potential, unique archaeological values, and to protect threatened and endangered species habitat. Some important resources within communities or in large blocks of private land that are adjacent to the national forest may not be considered important for acquisition under this criteria. As a result, the open space values and more isolated species habitats associated with these non-Federal lands may not be considered for a land adjustment case and could be lost to development under alternative A as they would not be consistent with the current acquisition criteria.

The 1985 plan states specific boundary and land line direction, but timeframes do not reflect current limitations in budget and the flexibility of Cibola staff to determine priority work. As a result, this direction is unachievable.

Environmental Consequences Common to Action Alternatives, B, C, and D

The effects would be the same to all action alternatives; without site-specific direction (specific lands to be acquired and conveyed) for acquisitions and conveyances as detailed in the 1985 plan, Cibola managers would have to rely on the resource characteristics of inholdings when evaluating land ownership adjustments. Under alternatives B, C, and D, plan direction would provide more flexibility to consider opportunities for land acquisitions as they arise and change priorities as needed without having to amend the land management plan. The removal of specific acreage of land to be acquired also removes the limitation on treatments and other management activities that were identified as such. This would result in better achievement of plan direction such as vegetative and fire and fuels objectives.

Alternatives B, C, and D would include guidelines describing characteristics of lands to be acquired or conveyed instead of identifying lands as base-in-exchange and a specific desired acquisition list. The criteria in alternative A are replaced with guidelines more focused on specific resources and less specific to location on the landscape. These guidelines would likely result in similar land adjustment cases to the 1985 plan, except for an emphasis on land adjustments that would result in more consistent or efficient forest management. While these non-Federal parcels adjacent to the Cibola do not include key natural resources that are specifically identified for possible acquisition in these alternatives, potential development of these parcels may result in other changes to surrounding National Forest System lands. The need for year-round access could result in either improved, paved roads, changes in recreation experience, watershed impacts on unimproved forest roads, and disturbance of wildlife species or habitat fragmentation from private land development within the national forest.

Working collaboratively with local governments and communities to resolve encroachments, to provide habitat connectivity, and improve all-lands management per the associated management approach may result in land exchanges being developed that meet community and forest needs. The draft land management plan also proposes collaboration with rural historic communities to ensure traditional and cultural uses are incorporated into the management of any newly acquired lands. These management approaches for collaboration with private landowners and local governments to protect forest values from adjacent development impacts could result in less habitat fragmentation and greater watershed health to forest resources from adjacent non-Federal uses by developing buffers on private lands.

Overall, the action alternatives are not substantially different from the 1985 plan, and adjustment guidelines and desired conditions reflect more succinctly the criteria of lands desired for Federal acquisition and those appropriate for conveyance. Open space values are included to address local concerns about land exchanges that result in conveyance of National Forest System lands.

There are common recommended wilderness areas adjacent to private property amongst the action alternatives. Recommended wilderness areas in the Mountainair District common to alternatives B, C, and D include the Manzano Wilderness expansions 4 and 5 that are adjacent to private land on the western boundaries. Wilderness designation could limit land exchange or other land adjustments in these areas if there were encroachments or other issues or needs related to those lands of other ownership that could not be resolved within the recommended wilderness areas.

Environmental Consequences to Alternative B

With respect to land ownership management, alternative B is not substantially different from alternatives C and D in terms of the lands program plan direction in the draft land management plan. The only exceptions would be where there are recommended wilderness areas adjacent to private land not proposed in alternative C. Panther Canyon, Magdalena Mountains 1, and Datil Mountains are adjacent to private land in alternative B (same as alternative D). Potential wilderness designation could limit land exchange or other land adjustments in these areas as they could not be resolved within the recommended wilderness areas.

Environmental Consequences to Alternative C

With respect to land ownership management, alternative C is not substantially different from alternatives B and D in terms of the lands program plan direction in the draft land management plan. The only exceptions would be where the restoration management areas are proposed. These new restoration accesses may cause unwanted public access or means of access (vehicle, pedestrian, etc.) to the area, based on the related resources. Similar to the development of lands of other ownership within the national forest boundaries, new access routes may draw new visitors in unanticipated areas with unanticipated expectations of public uses of the area requiring additional protection of resources, wildlife habitat and movement, riparian areas, and tribal and cultural areas may be impacted.

The accelerated restoration treatments would cause an increased need for additional boundary surveys to ensure Forest Service activities remain on the Cibola. More funding would need to be allocated to this service. Many of the services would be contracted out due to the limited survey staff within the region. Contracting would delay the timeframe in which the restoration could occur due to the length of the contracting process. Projects would need to be planned out well in advance to ensure enough time to complete the surveys before restoration work begins. Lack of funding and survey resources could mean Cibola personnel would need to make alternative choices about how to delineate the boundary. They may decide to use natural barriers within the boundaries of the Cibola as the boundaries for the restoration activities. The gap between the actual boundary and the natural barrier may remain unrestored and may limit the full effect of the restoration plans.

Additionally, legal access is needed to perform the restoration and to provide others access, such as access to tribal sites. Access through current National Forest System land may not be the best route to these areas, there may not be roads currently to those locations, or both. Access to these areas may result in new rights-of-way being created across National Forest System land and private land. Negotiated permanent easements may provide additional public access to areas where access was previously limited. Acquisition of that access may require purchase funds. If the landowner requires a purchase, because of negotiations and the time needed to perform the easement acquisition, such transaction may delay the restoration work.

Environmental Consequences to Alternative D

With respect to land ownership management, alternative D is not substantially different from alternatives B and C. The only exceptions would be where there are recommended wilderness areas adjacent to private property not proposed in alternatives B and C. These consist of multiple areas in the Magdalena District such as the following: Panther Canyon on the southwestern boundary, Withington Wilderness on the northeastern boundary, Apache Kid Wilderness Expansion 1 on the eastern boundary, Magdalena Mountains 1 on the northern boundary, Datil Mountains Wilderness on the eastern boundary, and Bear Mountains on the southwestern boundary. Areas recommended in the Mount Taylor District adjacent to private land include the Guadalupe area on the southwestern boundary, the Hogback area on the northern and eastern boundaries, and Little Water Canyon on the western boundary. In the Mountainair District, the Manzano Wilderness expansion 1 area is adjacent to private land on the eastern boundary. Potential designation could limit land exchange or other land adjustments in these areas if there were encroachments or other issues or needs related to those lands of other ownership that could not be resolved within the recommended wilderness areas.

Cumulative Environmental Consequences

The geographic area of analysis for cumulative impacts to forest lands is the Cibola mountain districts and adjacent lands. The Cibola is located within 10 counties in New Mexico: Bernalillo, Catron, Cibola, McKinley, Sandoval, Torrance, Valencia, Lincoln, Sierra, and Socorro. Some counties overlap one or more ranger district boundaries. The Cibola shares approximately 102 miles of common boundary with many tribal nations. For the Mount Taylor Ranger District, these are the Navajo Nation and the Acoma, Laguna, and Zuni Pueblos. The Mountainair Ranger District shares a boundary with the Pueblo of Isleta, and the Sandia Ranger District shares a boundary with the Pueblo of Sandia. Many other tribal nations have historical areas now managed by the Cibola.

The lands programs for adjacent national forests have similar requirements and the same relevant laws, regulations, and policies that apply to management of Federal lands. The acquisition of inholdings and the exchange of isolated Federal parcels would result in a consolidation of land ownership within national forest managed lands and improve land management objectives and activities. The Bureau of Land Management has very similar guiding laws, regulations, and policies. With an emphasis on land exchanges, public involvement is an important factor in determining whether an exchange is appropriate and for the benefit of the public and the Cibola. The public must be informed of the exchange early enough to be able to meaningfully contribute to an outcome for the benefit of the community. The result is an increased trust in the Forest Service's lands program and a greater potential for successful implementation of the exchange or other form of land adjustment case to acquire valued lands. Working collaboratively with local governments and communities early on the land exchange projects per the associated management approach may result in land exchanges being developed that meet community and forest needs and the parties then have the opportunity to discuss and agree to potential tradeoffs of open space values for other resource benefits.

The New Mexico State Land Department has a significant amount of State trust property adjacent to the forest and has a different mission for its management. It manages State trust lands and resources to enhance value and optimize economic return for the trust beneficiaries (schools, universities, hospitals and other important public institutions). The goal of the trust is to support the education of New Mexico's children in a manner consistent with sound stewardship, conservation and business management principles supporting socioeconomic goals for citizens here today and generations to come.

The availability of private lands in and around the Cibola National Forest is very limited, with private land parcels being isolated and widely dispersed. Future growth and development of adjacent lands of other ownership are expected to result in increased requests for special use authorizations; Educational Land Grant Act and Townsite Act applications for schools, fire stations, wastewater facilities, transfer stations; etc.. Encroachments onto National Forest System lands may increase, and Cibola personnel will need to use additional resources to prevent these activities from causing unexpected resource damage. Nevertheless, as Federal land management agencies acquire isolated private inholdings within their legislated boundaries, the efficiency of managing these areas should increase, and there should be fewer rights-of-way and other encumbrances across the greater landscape. Despite budgetary constraints, the Cibola National Forest is likely to continue to increase in acreage, albeit at a slower rate. As the complexity of land adjustment cases increase and budget and staffing decrease, lands of other ownership with important resources could be developed instead of acquired. Development of these non-Federal inholdings could result in increased costs and difficulty managing the Cibola and other management activities within surrounding forests, including conflicts with other forest users, limitations on or changes in recreation use, and access or increased access to areas typically closed during wet weather conditions. The result could be improved, paved access for national forest use and the need for year-round access. Additional effects include increased watershed impacts on unimproved forest roads, development of new utility corridors, increased disturbances of wildlife species or fragmentation of habitats, and possible changes to Cibola National Forest users' contact frequency with others. Moreover, there may be new or increased impacts to forest resources like loss of wildlife habitat, scenery, and potentially archeological resources, introduction of non-native species and loss of native vegetation, on National Forest System lands surrounding the development.

Other limitations include not being able to perform fuel treatments and other management activities on these parcels to better achieve vegetation or community fire plan objectives.

When lands adjacent to the Cibola are owned or managed by tribes, pueblos and local or State government, there is a lessened opportunity for Forest Service involvement in exchanges for community needs, which may result in lost opportunities to acquire key resource property or inholdings as these entities will want to maintain management or control over them due to lack of acceptable exchange properties. If, instead of acquisition, there would be a collaborative approach to the management, the result could be less habitat fragmentation and greater watershed health to the forest resources by developing buffers on private lands. Loss of wildland character is a good starting point and communication tool to work with adjacent non-Federal landowner who can work to protect those values, perhaps reducing encroachment cases. Community involvement allows for communities to identify important open space and encourages them to take some responsibility for preserving wildland and resource values. Collaboration with local communities and recognizing their desire for open space may help reduce the need for exchanges or help keep the exchanges local and reduce the need to look to the state level to identify potential exchange lands.

Special Uses

The environmental consequences in this section focus on the components of special uses that are useful to the decision maker and the public. Typically, nonrecreation special uses include roads, utilities, storage facilities, communications sites, research, and commercial filming. Recreation special uses include resorts, ski areas, outfitters and guides, recreation residences and a variety of uses that provide access to National Forest System lands through commercial ventures and numerous recreation events. Use and occupancy of National Forest System lands may be authorized when such use is determined to be in the public interest. The Cibola also authorizes military support activities using special use authorizations.

Affected Environment

Special uses authorizes nonpermanent activities that support the Forest Service mission and meet the needs of the public. Authorizations are a partnership between the Forest Service and private businesses and individuals to provide services, activities, and facilities.

Special uses authorizes occupancy and use of National Forest System lands for appropriate, safe activities that meet demonstrated public needs when consistent with the desired conditions for the specific area. Cibola personnel have issued over 400 special use authorizations for a variety of uses, including archaeological consultation, fiber optic cable, oil and gas pipelines, outfitter and guiding services, power lines, recreation residents, resorts, roads, communication uses, telephone and telegraph lines, and water transmission pipelines.

Authorizations may be short term, such as for recreation events or noncommercial group uses, or longer term such as resorts and communication uses. National emphasis on energy development and transmission is expected to grow, as are communication use site proposals. Requests for use of Federal lands for communication use sites are predicted to increase in the future as the population grows and new technologies emerge. Requests to use Federal lands for utilities transmission and energy development are also predicted to increase due to higher demand.

The effects of major development projects will most likely increase requests for special uses activities in the future such as utilities, roads and digital communication connections which will be addressed on a case-by-case basis, individually, following the Forest Service laws, regulations, and policies. Mitigations will be addressed using approved, appropriate techniques such as consolidating new developments along existing routes and corridors and construction that disturb less land and improve reclamation success.

Lands Special Uses

The Cibola attracts scientists, many of whom apply for a special use permit that authorizes them to conduct a variety of research studies on National Forest System lands. Special use permits are also issued by Forest Service personnel for land uses that support utility distribution and transmission lines at various locations on the Cibola. These provide (but are not limited to) telephone, fiber optic, electric, water, and gas services within an intermingled ownership of private and public lands. These include small-scale utilities such as wells and water systems managed by homeowners associations. Resource monitoring activities (such as weather stations) by State and Federal agencies are also authorized by special use permit.

Several sites on the Cibola facilitate long-distance communications in central New Mexico under special use authorizations. Many road use permits and easements authorize ingress and egress to private inholdings within the national forest boundary. Easements are granted to State agencies, county agencies, or both as special use authorizations to maintain their roads on National Forest System lands. Special use permits are issued to authorize facilities that support military training and road use.

Recreation Special Uses

The occupancy of National Forest System lands for the purpose of constructing family oriented, privately owned recreation residences was granted by the Act of March 4, 1915 which provided authority to set aside land, not exceeding five acres, for construction of summer homes and multi-year occupancy permits. Currently, seasonally occupied recreation residences are permitted on 2 of 4 ranger districts on the Cibola. No authorizations are being granted for new residences.

On the Cibola, outfitter and guiding permits can be granted to service providers for recreational activities, such as, without limitation, bird watching, hunting, hiking, horseback riding, rock climbing, jeep and van touring, bicycling, and outdoor and environmental education. Outfitting and guiding services on the Cibola have noticeably increased over the past few decades. Based on recent history, the demand for these permits is expected to increase. Traditional commercial guiding for large game and game bird hunting will continue but will most likely not increase substantially.

Significant existing special use permits on the Cibola include the Sandia Peak Aerial Tramway and the Sandia Ski Area located on the Sandia Ranger District. Another significant existing special use permit that occurs across the forest include the U.S. Air Force Military Training Exercises located on the Magdalena, Mountainair, Sandia, and Mt. Taylor Ranger Districts.

Environmental Consequences

Most of the direction for special uses comes from the Forest Service manuals and handbooks and, therefore, applies to all alternatives. The existing law, regulation, and policy governs special uses on the Cibola and can be found in the Forest Service Manual 2700, and Forest Service Handbook 2709.11, 2709.12, and 2709.14, which are independent from the land management plan and its alternatives.

All action alternatives would manage special uses consistent with the plan components for other resource areas such as heritage and wildlife.

Environmental Consequences Common to All Alternatives

Encouraging maximum use of existing utility corridors and communication sites is common direction to all alternatives. Combining and expanding uses along existing corridors or at existing sites results in keeping impacts to places where uses exist already. Additionally, consolidating impacts of new uses on scenery, recreation experiences, and wildlife habitat could reduce impacts of uses to potentially smaller areas of the Cibola. These guidelines direct potential land use applicants to locations already impacted versus creating new facilities in new areas. Uses should primarily remain in places that already have impacts, thus preserving undeveloped settings and scenic resources as well as reducing impacts to other resources such as soils, watersheds, and wildlife habitat and connectivity in remaining areas of the Cibola.

There is potential this guidance will not meet utility and communication needs and public expectations where new facilities are needed outside of existing corridors and sites. Plan amendments may be necessary to meet National Energy Policy and the National Telecommunications Act for potential new or expanded sites and utility corridors. Climate change and the potential increase in fire activity or tree mortality may increase the needs of utility companies (in particular those with aerial lines) to invest more in removing hazards or in repairs to facilities. This activity may also result in more open areas adjacent to these corridors and the inconsistency with scenery objectives of the linear look along utility corridors.

Environmental Consequences – Alternative A

This alternative reflects the 1985 plan, as amended, and does not account for specific special-use direction on processing that has been changed in policy and regulation since the 1985 plan was implemented. Some direction and terminology contained in the 1985 plan is no longer consistent with current regulation and screening criteria. Current regulations and direction would need to be followed to provide a legally defensible special-use permitting process. Therefore, the current direction in alternative A may create conflicting direction that would make approval of some special uses more difficult.

Under the 1985 plan, there is no direction for the development or implementation of communication site management plans on designated communications sites. The lack of a timeframe for completing the site management plan could result in incompatible uses being permitted in the same communication site.

Recreation and land special uses are governed by direction specific to individual resources and management areas in the 1985 plan. In general, effects on resources are minimized by mitigation and avoidance requirements specified in terms and conditions of permits that reflect standards and guidelines developed to conserve and preserve forest resources.

The 1985 plan provides no direction regarding management of resources to develop their adaptability and resiliency to climate change. Scientific predictions for the Southwest include atypical temperature and rainfall patterns that could adversely affect soils, water resources, vegetation, plant and wildlife species, and recreational settings. Degradation of resources may decrease the desirability of some areas for specific uses authorized by special use permits, such as outfitter and guide services. For example, changes in vegetation in riparian areas may reduce populations of species that attract bird watching and nature tours offered by outfitters and guides. This potentially could lead to either displacement by outfitters looking for other opportunities or could decrease the demand for special use permits.

Requests for special use permits for other special uses that do not depend on the integrity of natural resources, such as utility infrastructure, road use and maintenance, and siting and operation of communication sites, would not be expected to change.

Environmental Consequences Common to Action Alternatives B, C, and D

The action alternatives retain much of the special uses direction from the 1985 plan and includes direction that allows uses when they are compatible with other resource objectives. The draft land management plan contains more specific direction and desired conditions that describe where special uses can be compatible with other resources than the 1985 plan. Stronger objectives for scenic quality across the Cibola in the updated plan direction would result in more restrictions on future utility corridors and other larger-scale uses, limiting them mostly to existing corridors. This would result in protection of scenery values over more areas of the national forest and less infrastructure development potentially away from existing corridors.

The draft land management plan has a guideline that all designated communication sites shall have a site management plan in place prior to the start of operations. This site management plan must be consistent with the land management plan. This sets a timeframe for the Cibola to meet guidance, which would improve management efficiency, oversight, and compliance with the current policy. This additional requirement has no effect on the review, reissuance, or permitting of special use projects.

Environmental Consequences – Alternative B

Effects on Cibola resources in alternative B would likely be the same as those for the other action alternatives such that natural and recreation settings affected by special uses would remain more intact in terms of habitat connectivity, scenery, and visitor experience. The exception in terms of effects would be the recommended wilderness areas proposed in alternative B that are not proposed in alternative C (see map packet and designated areas section). These recommended wilderness areas under alternative B would result in minor new area limitations on potential new or expanded special uses and includes more acreage with primitive setting recreation objectives than the proposed action and alternative A but less than alternative D. However, these designations protect the primitive recreation experience and other wilderness values in these areas.

Environmental Consequences – Alternative C

Effects on Cibola resources in alternative C would likely be the same as those for the other action alternatives such that natural and recreation settings affected by special uses would remain more intact in terms of habitat connectivity, scenery, and visitor experience. The exception in terms of effects would be the proposed restoration management areas under alternative C. Because of the emphasis on providing greater restoration opportunities than the other alternatives, alternative C may encourage an increase in special use authorizations of outfitter-guide services for motorized recreation. This has the potential to increase the intensity of effects of motorized use on natural resources such as soil erosion and sedimentation. There would be minimal effects from recreation special uses because of the short-term nature and because of the terms and conditions within the permit that the holder is supposed to abide by.

Environmental Consequences – Alternative D

Effects on Cibola resources in alternative D would likely be the same as those for the other action alternatives such that natural and recreation settings affected by special uses would remain more intact in terms of habitat connectivity, scenery, and visitor experience. The exception in terms of effects would be the recommended wilderness areas proposed in alternative D that are not proposed in alternatives B or C (see map packet and designated areas section). These recommended wilderness areas under alternative D would result in new area limitations on potential new or expanded special uses and include more acreage with primitive setting recreation objectives than alternatives A, B, or C. These designations protect the primitive recreation experience and other wilderness values in these areas more than the other action alternatives.

Additional recommended wilderness could restrict management of existing authorized uses and could limit new uses. Some of the recommended wilderness areas under alternative D cover large areas adjacent to highway and utility corridors and could limit any potential expansion of these corridors. Recommended wilderness areas in alternative D could limit any new special use permits and would restrict motorized and mechanized activities associated with existing authorized uses on the edges of these areas.

Cumulative Environmental Consequences

The geographic area of analysis for cumulative impacts to special uses is the planning area and lands adjacent to the Cibola National Forest boundary. Future energy development adjacent to the Cibola may increase the likelihood of energy development on the Cibola and the subsequent issuance of special use permits. When a special use proposal is received, Forest Service manual direction requires Cibola National Forest personnel to consider whether the proposed use is consistent with the mission of the Forest Service or can reasonably be accommodated on lands of other ownership. Private lands can provide opportunities for requests such as wind and solar power and small distribution lines but not for activities requiring large continuous land bases such as for hunting, tours, and access and utilities for in-holdings.

The special use programs for the Cibola, Carson, and Santa Fe National Forests have the same general requirements as they are guided by the same laws, regulations, and policies that apply to the management of Federal lands. The restrictions and limitations placed on the special use programs are likely to vary between the national forests due to differing concerns or needs of the areas' resource management.

Some restrictions to special use authorization would be required to meet the desired conditions, standards, and guidelines for other resource areas addressed in the action alternatives in the draft land management plan. The cumulative consequences of any of the proposed alternatives would not be significant as they would have little to no effect on the activities and opportunities for these types of uses across the greater landscape. Cumulative impacts to special uses could occur through changes in the designation and development of land resources and the need for access. The presence of threatened, endangered, and sensitive species and historical and archaeological features and concerns may preclude the issuance of some land use authorizations and place restrictions on others.

Population growth in central New Mexico has increased demand for special uses related to public goods and services, such as utilities, in and around the Cibola. Popular recreational uses of the Cibola and adjacent areas are greater in the summer on the sky islands and more popular at lower elevations during the winter. These special uses are likely to increase correspondingly with population growth in central New Mexico.

As a consequence of potential designation of wilderness areas, outfitter-guide uses and recreation events and placement of utility infrastructure may be displaced to lands of other ownership. This may increase the cost of doing business to the service provider or utility and affect resources near, but outside the Cibola.

Resource effects from outfitter-guide activities and recreational events are for the most part minimal. Considering the effects of such national forest activities together with those that are displaced outside the national forest, future cumulative effects are also expected to be minimal. This conclusion is based on the recognition that effects from each activity, if any, would be highly localized either within or outside the national forest. Thus, while both may occur within the boundaries of the cumulative effects analysis area, it is unlikely that both would affect the same localized resources at the same time.

Terrestrial, Aquatic, and Botanical Species

Regulatory Framework for Wildlife

The Forest Service is legally required to comply with a number of federal laws, regulations, and policy regarding wildlife, including: the Endangered Species Act of 1973, as amended; the Bald and Golden Eagle Protection Act of 1940, as amended; the Forest Service Manual 2600; the National Forest Management Act of 1976, as amended, and its 2012 implementing regulations for species of conservation concern; the Migratory Bird Treaty Act of 1918 (as amended), Executive Order 13186 (migratory birds), and the National Environmental Policy Act, 1969.

- The Endangered Species Act requires the Forest Service to manage for the recovery of threatened and endangered species and the ecosystems, upon which they depend. National forest personnel are also required to consult with the U.S. Fish and Wildlife Service personnel if a proposed activity may affect the population or habitat of a listed species. A separate biological assessment will be developed for consultation with the U.S. Fish and Wildlife Service.
- National Forest Management Act (NFMA) regulations define a viable population as one that "continues to persist over the long term with sufficient distribution to be resilient and adaptable to stressors and likely future events" (36 CFR section 219.19 [2012]).

- Forest Service manual direction provides additional guidance for proposed and listed threatened and endangered species. It also requires that Forest Service personnel identify and prescribe measures to prevent adverse modifications or destruction of critical habitat and other habitats essential for the conservation of endangered, threatened, and proposed species (Forest Service Manual 2670.31 (6)). Forest Service Manual 2600 –Wildlife, fish and sensitive plant habitat management, chapter 2670 – threatened, endangered, and sensitive plants and animals provides directions on conducting a biological evaluation and what type of information should be provided within this document. The objectives of biological evaluations are 1) to ensure Forest Service actions do not contribute to loss of viability of any native or desired nonnative plant or contribute to animal species or trends toward Federal listing of any species; 2) to comply with the requirements of the Endangered Species Act that actions of Federal agencies not jeopardize or adversely modify critical habitat of federally listed species; and 3) to provide a process and standard to ensure threatened, endangered, proposed, and sensitive species receive full consideration in the decision-making process (2672.41).
- The Forest Service manual directs the regional forester to identify sensitive species for each national forest where species viability may be a concern. Forest Service Manual 2670.32 gives direction to analyze, if impacts cannot be avoided, the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole.
- The Migratory Bird Treaty Act established an international framework for the protection and conservation of migratory birds. This act makes it illegal, unless permitted by regulations, to "pursue, hunt, take, capture, purchase, deliver for shipment, ship, cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird." Within the National Environmental Policy Act process, effects of proposed actions on migratory birds will be evaluated and actions will consider approaches to identify and minimize take (USDA FS 2008). To comply with the act, the Cibola National Forest personnel have used Executive Order 13186 (2001) and the memorandum of understanding with U.S. Fish and Wildlife Service signed in 2009 in pursuant to the Executive Order 13186.
- Bald and Golden Eagle Protection Act (Eagle Act). The Eagle Act, originally passed in 1940, prohibits the take, possession, sale, purchase, barter, offer to sell, purchase, or barter, transport, export, or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16 U.S.C 668(a); 50 CFR 22). "Take" is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb" a bald or golden eagle. The term "disturb" under the Eagle Act means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. The U.S. Fish and Wildlife Service staff recently revised the regulations for eagle nonpurposeful take permits and eagle nest take permits. (Federal Register 81:91494-91553; 16 December 2016) under the Eagle Act (50 CFR 22.26). The regulations provide for individual and programmatic permits that are consistent with the goal of stable or increasing eagle breeding populations.
- Southwestern Region's strategy for the protection and restoration of native plant communities (USDA Forest Service, Regional Office 1999).

Assumptions

In the analysis for this resource, the following assumptions have been made:

- The draft land management plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carry out any project or activity (including ground-disturbing actions). It does not result in direct effects; however, there may be implications or longer term indirect or cumulative environmental consequences from managing the forests under this programmatic framework.
- Before any ground-disturbing actions take place, they must be authorized in a subsequent site-specific environmental analysis. Therefore, none of the alternatives would cause unavoidable adverse impacts or an irreversible or irretrievable commitment of resources.
- The plan decisions (desired conditions, objectives, standards, guidelines, and management areas) will be followed when planning or implementing site-specific projects and activities.
- Law, regulation, and policy regulations will be followed when planning or implementing site-specific projects and activities.
- Funding levels will be similar to the past 5 years.
- The planning timeframe for the effects analysis is 10 to15 years, although other timeframes may be specified in the analysis, depending on the resource and potential consequences.
- Monitoring identified in the plan's monitoring chapter will occur.
- The land management plan will be amended, as needed, during the life of the plan.

For the following analysis, all alternatives are evaluated in terms of how well they achieve the same set of desired conditions, regardless of whether the alternative articulates those desired conditions.

Species Diversity

This analysis evaluates and discloses the potential environmental consequences on the biological resources that may result with the adoption of a revised land management plan. The report includes terrestrial and aquatic wildlife and botanical species that are federally listed, bald and golden eagles, Forest Service sensitive species, species of conservation concern, and migratory bird priority species that may occur or may have habitat within the project area. This section examines, in detail, four different alternatives for revising the 1985 plan and effects on the wildlife resource.

Existing Condition

The Cibola National Forest is one of five national forests in New Mexico, occupying approximately 1.611 million acres within 10 counties. The four ranger districts addressed in this analysis are the Sandia, Mountainair, Magdalena, and Mt. Taylor Ranger Districts. Within these four districts, are nine separate mountainous parcels ("sky islands") scattered throughout central New Mexico: Sandia Mountains, Manzano Mountains, Gallinas Mountains, Magdalena Mountains, San Mateo Mountains, Bear Mountains, Datil Mountains, Zuni Mountains, and Mt Taylor. A small mountain range—the Manzanita Mountains—lies between the Sandia and Manzano Mountains and is included in the Sandia Ranger District (see chapter 1).

Elevations within the four forested, mountainous ranger districts extend from 5,200 feet (along the eastern edge of the Magdalena Ranger District) to over 11,300 feet (at the summit of Mt. Taylor) above mean sea level. The lower elevations of the Cibola are rolling, hilly terrain cut by sandy washes and small canyons. Rock outcrops are prevalent. With an increase in elevation, the terrain becomes truly mountainous, with prominent canyons and exposed rock faces. There are numerous peaks in excess of 9,000 feet.

Elevation is the dominant localized influence on climate. The lower elevations receive less than 10 inches of precipitation per year, with temperature extremes above 100 degrees Fahrenheit in the summer and well below freezing in the winter. The higher elevations receive in excess of 24 inches of precipitation each year, with summer temperatures in the 80s and winter temperature at zero or below.

The most predominant vegetation type on the Cibola is pinyon-juniper woodland (about 36 percent). The remainder comprises primarily ponderosa pine forest (nearly 28 percent), mixed conifer forest (about 12 percent), and semi-desert to mountain grassland (about 11 percent). There are also a number of isolated riparian areas at springs, seeps, creeks, and lakes. The Cibola National Forest is predominantly a dry forest ecosystem. The main vegetation system drivers on the forest are fire disturbances (or lack thereof), regional climate regime, insects and disease, and natural vegetation succession.

This evaluation is based upon all federally listed, proposed, and candidate species and designated and proposed critical habitats that the U.S. Fish and Wildlife Service has identified for consideration,[42] the most recent sensitive species list (2013), and the species of conservation concern list developed by the Cibola as part of the ecological assessment report for the plan revision process (USDA Forest Service 2015a). There are 34 animal species, 3 aquatic species, and 5 plant species on the Cibola National Forest addressed by this analysis. Species that do not occur in the analysis area or do not have habitat in the analysis area were dropped from further consideration.

Federally Listed Species

Federally listed threatened and endangered species are those plant and animal species formally listed by the U.S. Fish and Wildlife Service under authority of the Endangered Species Act of 1973, as amended. Pursuant to section 7(2)(a) of the act, a biological assessment will be prepared to assess the effects of implementing the draft land management plan preferred alternative on endangered and threatened species and ensure that proposed actions in the selected alternative would not jeopardize the continued existence of listed species. Only those species that use the national forest, have suitable habitat present, and or could be impacted by off-forest management effects (for example, downstream effects) were fully analyzed. There would be no effect under all alternatives to species not fully analyzed.

There are 5 federally endangered species (2 are experimental populations) and 4 threatened species relevant to the plan area and to the planning process (table 79). Not all species are known to exist on the planning unit, but are located close enough where they could still be affected. The Chiricahua leopard frog and the Alamosa springsnail have been recorded immediately off the national forest boundary but are within the same watershed as the Cibola and are affected by adjacent management actions. Likewise, the southwestern willow flycatcher is not currently occupying any territories on the Cibola National Forest, but it has been documented on the Cibola in the past. The western yellow-billed cuckoo potentially uses the Cibola only as migrant and has not been documented here; however, proposed critical habitat on the Rio Grande could be affected by downstream effects resulting from forest-level management.

[42] An updated official list of threatened, endangered, and proposed species to consider during this analysis was obtained from the U.S. Fish and Wildlife Service Information for Planning and Consultation (IPaC) website on June 14, 2019 (U.S. Fish and Wildlife Service 2019).

The Mexican gray wolf and the northern Aplomado falcon are not presently documented to den or breed on the Cibola, but they routinely use the national forest for foraging. Mexican spotted owl, Zuni bluehead sucker, and Zuni fleabane are known to be present on the Cibola, and there are long-standing records documenting that presence.

Table 79. Federally listed, proposed, and candidate species and designated or proposed critical habitats (CH) known or thought to occur on the Cibola National Forest[43]

Common Name	Scientific Name	Federal Status[1]	Critical Habitat	Recovery Plan	Districts Known or Potential[2]
Chiricahua leopard frog	*Lithobates chiracahuensis*	T	Yes, CH just off of MGR boundary	Yes	None, but small population just off of forest boundary.
Mexican spotted owl	*Strix occidentalis lucida*	T	Yes	Yes	All
Northern Aplomado falcon	*Falco femoralis septentrionalis*	E, EXPN	None designated	No	Foraging only
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	Yes, but none in analysis area	Yes	MTR and MAR historically, but not documented in 15 years. Possible downstream effects to CH.
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	T	Proposed but not in analysis area	No	Potential (migration habitat). Possible downstream effects to PCH.
Mexican gray wolf	*Canis lupus*	E, EXPN	None designated	Yes	MGR-foraging only, no breeding or denning
Alamosa springsnail (mollusk)	*Tryonia alamosae*	E	None designated	Yes	None, but found just off of forest boundary adjacent to MGR-possible downstream effects.
Zuni bluehead sucker	*Catostomus discobolus yarrowi*	E	Yes, CH Zuni Mountains	No	MTR
Zuni fleabane	*Erigeron rhizomatus*	T	None designated	No	MTR and MGR

MGR=Magdalena Ranger District, MTR=Mt. Taylor Ranger District, MAR=Mountainair Ranger District, SAR=Sandia Ranger District, T=Threatened, E=Endangered, EXPN=Experimental Population, Non-Essential, CH=Critical Habitat

In addition to federally listed species, several other categories of at risk species are managed by Forest Service staff: 20 species of conservation concern, and 15 regionally sensitive species. Categories are not mutually exclusive, as many of the species have more than one status assigned (table 80 and table 81).

Species of Conservation Concern

A species of conservation concern is defined by the 2012 planning rule as "a species, other than federally recognized threatened, endangered, proposed, or candidate species, that is known to occur in the plan area and for which the regional forester has determined that the best available scientific information indicates substantial concern about the species' capability to persist over the long-term in the plan area."

[43] The four national grasslands administered by the Cibola Supervisor's Office are managed under a land management plan approved and implemented in 2012. The four national grasslands will not be addressed for this revision effort (forest plan) or biological assessment.

The Cibola National Forest followed the guidance provided in the proposed directives for the Rule (Forest Service Handbook 1909.12 – Land management planning, chapter 10) in developing this list. Additional information on this process and the species selected can be found in chapter 7 (Identifying and assessing at-risk species in the plan area), volume 1 of the ecological assessment for the Cibola National Forest mountain ranger districts (USDA Forest Service 2015a).

Under 36 CFR 219.9(b)(1), the responsible official, in this case the forest supervisor for the Cibola National Forest, must determine whether the plan components required by 36 CFR 219.9(a) provide the ecological conditions necessary to "contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern[2] within the plan area." Because the draft land management plan relies heavily upon desired conditions to frame the movement of the Cibola's ecological conditions over time, it also includes standards and guidelines to ensure project-level, site-specific contributions to the plan area needs for at-risk species are considered early in a project's environmental planning process. Plan components are numbered sequentially, but this does not reflect rank or priority.

For many species, essential ecological conditions may be provided for through ecosystem level (also known as coarse-filter) plan components that include desired conditions for specific vegetation types. These ecosystem level plan components may be adequate to ensure persistence of most species and maintain viable populations within the plan area. For other species, species-specific (also known as fine-filter plan) components that are more specialized (timing restrictions, etc.) may be required to ensure persistence and viability (see discussion below on ecosystem and species-specific filter process.).

In brief, substantial concern about the species' capability to persist over the long term in the plan area, is evidenced by one or more of the following criteria:

- habitat is limited or rare within the plan area
- current management activities are negatively impacting habitat within the plan area
- available monitoring indicates a decline in population, range, or both within the plan area

Southwestern Region Sensitive Species

The sensitive species program is the Forest Service's dedicated initiative to conserve and recover plant and animal species according to Forest Service policy (Forest Service Manual 2670). Cibola National Forest personnel improves habitat and restore ecosystems for sensitive species through vegetation treatments and management practices. Sensitive species are those plant and animal species identified by a regional forester for which population viability is a concern, as evidenced by the following:

- significant current or predicted downward trends in population numbers or density
- significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution

Regionally sensitive species considered in this analysis are found in table 81. Additional information on each regional forester's sensitive species and its status on the Cibola National Forest can be found in the regional forester's sensitive species list reference document for the Cibola National Forest (USDA Forest Service 2013d).

Table 80. Species of conservation concern and key ecological conditions

Scientific Name	Common Name	Status	Special Habitat Features[44]	Primary Vegetation Type
Corynorhinus townsendii pallescens	Pale Townsend's big-eared bat	SCC	Rock, aquatic	CDS, PJO, PJW
Myotis occultus	Arizona myotis	SCC	Tree, rock, aquatic	PPF, Riparian
Cynomys gunnisoni	Gunnison's prairie dog	SCC	Soil	CDS, JUG,SAGE, SDG
Ovis canadensis canadensis	Rocky Mountain bighorn sheep	SCC	Rock	DMC,MCW, MSG, Riparian
Accipiter gentilis	Northern goshawk	SCC	Tree	DMC,MCW, PPF, SFF
Athene cunicularia hypugaea	Burrowing owl	SCC	Soil (burrows-presence of prairie dog colonies).	CSDS, JUG, SAGE SDG
Baeolophus ridgwayi	Juniper titmouse	SCC	Tree	PJO
Cardellina rubrifrons	Red-faced warbler	SCC	Soil and tree	PPF, DMC, Riparian
Dendroica graciae	Grace's warbler	SCC	N/A	PPF, DMC
Falco peregrinus anatum	American peregrine falcon	SCC	Rock	Cliffs and Rocky Outcrops, Multiple vegetation types
Lanius ludovicianus	Loggerhead shrike	SCC	Tree	CPGB, SDG, SAGE
Melanerpes lewis	Lewis's woodpecker	SCC	Tree	DMC, PPF, Riparian
Toxostoma bendirei	Bendire's thrasher	SCC	N/A	PJO, SDG, CSD,
Vireo vicinior	Gray vireo	SCC	N/A	JUG, PJE, PJO,MMS
Lithobates pipiens	Northern leopard frog	SCC	Aquatic	Riparian
Streptocephalus henridumontis	Dumont's fairy shrimp	SCC	Aquatic	Riparian
Gila pandora	Rio Grande chub	SCC	Aquatic	Riparian
Catostomus plebeius	Rio Grande sucker	SCC	Aquatic	Riparian
Astragalus accumbens	Zuni milkvetch	SCC	Rock and soil	PJ woodland
Astragalus humistratus var. *crispulus*	Villous groundcover milkvetch	SCC	Soil	Ponderosa Pine Forest
Erigeron sivinskii	Sivinski's fleabane	SCC	Rock and soil	Colorado Plateau/Great Basin Grassland and PJ Woodland
Heuchera pulchella	Sandia Mountain alumroot	SCC	Rock and soil	Mixed conifer-aspen

Key: MSG=Montane/Subalpine Grassland, GAMB=Gambel oak shrubland, MMS=Mountain Mahogany Mixed Shrubland, SAGE=Sagebrush shrubland, SAND=Sandsage, CPGB=Colorado Plateau/Great Basin Grassland, ISS=Intermountain Salt Scrub, SDG=Semi-Desert Grassland, CDS=Chihuahuan Desert Scrub, SFF=Spruce Fir Forest, MCW=Mixed conifer with aspen, or wet mixed conifer, DMC=Dry mixed conifer or mixed conifer-frequent fire or, PPF=Ponderosa pine forest, PJ=Pinyon juniper, JUG=juniper grass, PJC=PJ evergreen shrub, PJO=PJ woodland, PJG=PJ grass, MPO= Madrean pinyon-oak woodland, Riparian SCC=Species of Conservation Concern; RFSS=Regional Forester's Sensitive Species; MB=Birds protected under the Migratory Bird Treaty Act. Full descriptions of vegetation types can be found in the vegetation section of this document.

[44] Habitat features needed to maintain viability that are not necessarily captured by broad vegetation type descriptions. Special habitat features are described in detail in chapter 7 (Identifying and assessing at-risk species in the plan area), volume 1 of the ecological assessment for the Cibola National Forest mountain ranger districts (USDA 2015a).

Table 81. Regionally sensitive species and key ecological conditions

Scientific Name	Common Name	Status	Special Habitat Features[45]	Primary Vegetation Type
Corynorhinus townsendii pallescens	Pale Townsend's big-eared bat	RFSS	Rock Aquatic	CDS, PJO, PJW
Idionycteris phyllotis	Allen's lapped browed bat	RFSS	Rock Aquatic	PPF, DMC
Euderma maculatum	Spotted bat	RFSS	Rock and aquatic	SAGE, MSG, CPGB, SDG
Cynomys gunnisoni	Gunnison's prairie dog	RFSS	Soil	CDS, JUG,SAGE, SDG
Accipiter gentilis	Northern goshawk	RFSS	Tree	DMC,MCW, PPF, SFF
Haliaeetus leucocephalus	Bald eagle	RFSS	Tree, Aquatic	Riparian
Athene cunicularia hypugaea	Burrowing owl	RFSS	Soil (burrows-presence of prairie dog colonies).	CSDS, JUG, SAGE SDG
Falco peregrinus anatum	American peregrine falcon	RFSS	Rock	Cliffs and Rocky Outcrops, Multiple vegetation types
Vireo vicinior	Gray vireo	RFSS	N/A	JUG, PJE, PJO,MMS
Lithobates pipiens	Northern leopard frog	RFSS	Aquatic	Riparian
Streptocephalus henridumontis	Dumont's fairy shrimp	RFSS	Aquatic	Riparian
Oreohelix magdalenae	Magdalena mountain snail	RFSS	Igneous stone, leaf litter, moisture	Multi
Gila pandora	Rio Grande chub	RFSS	Aquatic	Riparian
Catostomus plebeius	Rio Grande sucker	RFSS	Aquatic	Riparian
Astragalus accumbens	Zuni milkvetch	RFSS	Rock and soil	PJ woodland
Astragalus humistratus var. *crispulus*	Villous groundcover milkvetch	RFSS	Soil	Ponderosa Pine Forest
Erigeron sivinskii	Sivinski's fleabane	RFSS	Rock and soil	Colorado Plateau/Great Basin Grassland and PJ Woodland
Heuchera pulchella	Sandia Mountain alumroot	RFSS	Rock and soil	Mixed conifer-aspen

Key: MSG=Montane/Subalpine Grassland, GAMB=Gambel oak shrubland, MMS=Mountain Mahogany Mixed Shrubland, SAGE=Sagebrush shrubland, SAND=Sandsage, CPGB=Colorado Plateau/Great Basin Grassland, ISS=Intermountain Salt Scrub, SDG=Semi-Desert Grassland, CDS=Chihuahuan Desert Scrub, SFF=Spruce Fir Forest, MCW=Mixed conifer with aspen, or wet mixed conifer, DMC=Dry mixed conifer or mixed conifer-frequent fire, PPF=Ponderosa pine forest, PJ=Pinyon juniper, JUG=juniper grass, PJC=PJ evergreen shrub, PJO=PJ woodland, PJG=PJ grass, MPO= Madrean pinyon-oak woodland, Riparian; RFSS=Regional Forester's Sensitive Species. Full descriptions of vegetation types can be found in the vegetation section of this document.

[45] Habitat features needed to maintain viability that are not necessarily captured by broad vegetation type descriptions. Special habitat features are described in detail in chapter 7 (Identifying and assessing at-risk species in the plan area), Volume 1 of the ecological assessment for the Cibola National Forest mountain ranger districts (USDA 2015a)

Migratory Birds

Executive Order 13186 outlines the responsibilities of federal agencies to protect migratory birds. Section 3(e)(5) which provides direction for revision of agency management plan states the following:

> "within established authorities and in conjunction with the adoption, amendment, or revision of agency management plans and guidance, ensure that agency plans and actions promote programs and recommendations of comprehensive migratory bird planning efforts such as Partners-in-Flight, U.S. National Shorebird Plan, North American Waterfowl Management Plan, North American Colonial Waterbird Plan, and other planning efforts, as well as guidance from other sources, including the Food and Agricultural Organization's International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries."

Recent reports produced by the North American Bird Conservation Initiative and known as "State of the Birds" reports paint a picture of declines in multiple species across a variety of habitats. The 2011 report (North American Bird Conservation Initiative 2011) focused on public lands and waters and stated that "[n]atural processes must be restored to ensure functional and resilient ecosystems through management actions such as control of nonnative species and diseases, prescribed cuts and burns to reinvigorate forests and grasslands, and water delivery and management to sustain wetlands". For arid lands, the report identified the need to focus on "control of invasive plant species; keeping fire and other forms of disturbance within normal limits; promoting natural patterns of plant succession; and helping birds and other biodiversity adapt in the face of climate and land-use change" (Ibid.). For forest birds and western forests, the report identified the single most important need as restoration of natural fire regimes and control of invasive species (for example, plants, insect pests, and diseases) was also highlighted.

Many of the federally listed, sensitive, and species of conservation concern addressed in this analysis are migratory birds associated with a wide variety of habitats. By ensuring the persistence of these species, as well as accomplishing restoration of systems as outlined in the paragraph above, the needs of migratory bird species will be met. Relative effectiveness in addressing restoration and resiliency among the alternatives is, therefore, included in the analysis of effects for individual bird species addressed below and further clarified under the action alternatives.

Ecological Conditions

Vegetation Types

Species cannot be managed apart from their habitats and much of the assessment of species on the Cibola National Forest focused on potential and actual habitat available on the forest. Riparian and terrestrial vegetation types were used to describe and map units of similar vegetation, soil, climate, and ecosystem disturbance across the landscape. These vegetation types are the basis for analysis of vegetative component of species' habitat and represent the ecological conditions that support persistence and viability at the ecosystem level. In general, systems that are more highly departed from reference conditions and with high representation on the forest will have greater effects on species than systems that have low departure and low forestwide representation. An exception to this is riparian systems which have disproportionally high effects on species relative to their low representation on the Cibola.

Terrestrial Habitat

There are 20 (primary) terrestrial vegetation types on the Cibola, largely dominated by pinyon juniper vegetation and ponderosa pine which combined, cover approximately 64 percent of the analysis area (table 82). Most are moderately to highly departed from reference conditions and trending away. Trend was not calculated for those vegetation types that were too small to adequately assess. Refer to chapter 2, "Vegetation", in the ecological assessment report volume 1 and the vegetation analysis in this document for additional detail on vegetation types (USDA Forest Service 2015a). Those vegetation types that are highly departed from reference conditions are shaded for emphasis.

Table 82. Primary vegetation types, departure from reference conditions, and trend on the Cibola

Vegetation Type	Acres on the Forest (% of Forest)	Current Vegetation Departure[46]
Spruce Fir Forest (SFF)	7,766 (5%)	Moderate (45%)
Mixed Conifer with Aspen (MCW)	32,942 (2%)	Moderate (62%)
Mixed conifer-frequent fire (DMC)	157,234 (10%)	High (69%)
Ponderosa pine forest (PPF)	455,546 (28%); PPF bunchgrass=33,920 (2%), PPF gamble oak=421,626 (26%)	High (98%); PPF bunchgrass=97%, PPF evergreen oak=98%)
Pinyon juniper evergreen shrub (PJC)	22,656 (1%)	High (75%)
Pinyon juniper woodland (PJO)	266,293 (17%)	Moderate (55%)
Pinyon juniper grass (PJG)	292,003 (18%)	Moderate (50%)
Juniper grass (JUG)	92,596 (6%)	Moderate (57%)
Madrean pinyon-oak woodland (MPO)	29,399 (2%)	High (75%)
Montane/subalpine grassland (MSG)	41,519 (2.6%)	Low (28%)
Colorado Plateau/Great Basin Grassland (CPGB)	24,094 (1.5%)	Moderate (45%)
Semi-desert grassland (SDG)	113,965 (7%)	Low (31%)
Mountain mahogany mixed shrubland (MMS)	18,007 (1%)	Low (8%)
Gambel oak shrubland (GAMB)	37,193 (2%)	Moderate (47%)
Sagebrush Shrubland (SAGE)	2,658 (.2%)	Not assessed
Intermountain salt scrub (ISS)	3,302 (.2%)	Not assessed
Chihuahuan salt desert scrub (CSDS)	2,971 (.2%)	Not assessed
Chihuahuan desert scrub (CDS)	590 (.04%)	Not assessed
Sandsage (SAND)	5,093 (.3%)	Not assessed
Riparian[47]	7,578 (.5%)	High[48]
Total	1,613,414	

[46] Vegetation type departure: 0 to 33 percent = low, 34 to 66 percent = moderate, 67 to 100 percent = high
[47] Modeled by the Regional Riparian Mapping and Assessment Project (RMAP) (Triepke et al. 2013)
[48] Assessed using proper functioning condition, a methodology for assessing the physical function of riparian and wetland areas

Aquatic and Riparian Habitats

Watersheds

A watershed is a "region or land area drained by a single stream, river, or drainage network; a drainage basin" (36 CFR 219.19). These drainage areas are defined by the highest elevations surrounding a selected location on a stream so that a drop of water falling inside the boundary will drain to the stream while a drop of rain falling outside of the boundary will drain to another watershed. Watersheds encompass all of the ecosystem elements—water, soils, vegetation, and animals. Watersheds also span the landscape at many different scales. Watershed boundaries cross ownership boundaries since they are based on topography. A systematic method of delineating watershed boundaries and giving them a number code was developed by the U.S. Geological Survey (USGS) (Seaber et al. 1987). The number code is called the hydrologic unit code.

This analysis uses the 5th-level hydrologic unit code (watershed) and the 6th-level hydrologic unit code (subwatershed) at the broadest scales, above the planning unit. The individual mountain units are used as the analysis unit at the finer scale. The 5th-level watersheds range from 60,000 to 320,000 acres and were used to assess stressors and risk of impaired watershed condition. The 6th-level subwatersheds range in size from 10,000 to 50,000 acres and were used to assess watershed condition and the factors that contribute to watershed condition.

Four subwatersheds (6th hydrologic unit code) contain the federally endangered Zuni bluehead sucker and the species of conservation concern Rio Grande sucker and Rio Grande chub. The Zuni bluehead sucker and its critical habitat currently occur in the Upper Rio Nutria, Cebolla Creek, and Middle Rio Nutria. The Rio Grande sucker and Rio Grande chub are currently located within the Agua Medio-Bluewater.

The four subwatersheds in table 83 are rated fair for watershed condition, which means they are functioning at risk. They support medium to small blocks of contiguous habitat, some high-quality aquatic habitat is available, but stream channel conditions show signs of being degraded (USDA Forest Service 2011c). Watershed condition and abundance information was determined using the watershed condition classification document, and the assessment report (USDA Forest Service 2015a).

Riparian Areas

Riparian areas are associated with perennial waters (streams and springs), intermittent streams, and springs. There are two aspects of risk to riparian areas, condition, and extent. Both of these are departed from reference condition.

Riparian habitat on the Cibola National Forest is composed of several Riparian Mapping and Assessment Project (RMAP) associations: Arizona Alder-Willow, Arizona Walnut, Desert Willow, Fremont Cottonwood-Conifer, Fremont Cottonwood-Oak, Fremont Cottonwood/Shrub, Herbaceous, Narrowleaf Cottonwood/Shrub, Ponderosa Pine/Willow, Rio Grande Cottonwood/Shrub, Upper Montane Conifer/Willow and Willow-Thinleaf Alder (table 83). Most riparian areas on the Cibola are currently at risk and completely missing in some places. This is a largely a function of legacy issues, including roads (authorized or otherwise), uncharacteristic wildland fire, developed recreation, dispersed recreation, historically unmanaged grazing by livestock and unmanaged herbivory by wildlife, and water development and diversion both on and off the Cibola National Forest. Riparian areas can also be impacted by climate trends such as drought.

The condition of Cibola riparian areas was assessed as part of the classification of watershed condition (USDA Forest Service 2011c). This assessment used proper functioning condition assessments where available, to determine the condition rating for the riparian indicator. Riparian areas in the plan area were rated as good or functioning properly on 96 (46 percent) of the 6th-code subwatersheds. A fair rating, functioning at risk, was given to 70 (34 percent) of the 6th-code subwatersheds. None of the watersheds were rated as poor or impaired. Forty-two (20 percent) 6th code subwatersheds were not rated since these subwatersheds have less than 10 percent of their area within the plan area. It should be noted that where no riparian areas exist within a subwatershed, a rating of good was assigned, unless the subwatershed has less than 10 percent on National Forest System lands. Given this information, on the one hundred and thirteen 6th code subwatersheds which do have riparian areas, 53 percent are rated as fair, 35 percent are rated as good, and 12 percent were not rated. The overall habitat trend of riparian habitat is expected to decline and the trend is downward (USDA Forest Service 2014b). Riparian areas in the Manzano Mountains, Magdalena Mountains, and Bear Mountains Geographic Areas (GAs) have a high risk due to low acres and distribution largely located within the plan area. The Sandia Mountains, Mt. Taylor, Zuni Mountains, and Datil Mountains Geographic Areas are moderately at risk due to distributions outside as well as within the plan area. The San Mateo Mountains Geographic Area has a good diversity of riparian area located outside and inside the plan area, resulting in a low rating.

Table 83. Riparian habitat on the Cibola National Forest by geographic area unit

Geographic Area Unit	Riparian Area for all 6th-Code HUCs (acres)	Riparian Area for National Forest System Lands (acres)	National Forest System Lands Portion of Total Riparian in the 6th-Code HUCs (%)
Bear	1,088.05	64.97	5.97
Datil	1,659.91	1,629.99	98.20
Gallinas	5,848.47	8.37	0.14
Magdalena	372.20	257.44	69.17
Manzano	4,061.20	612.93	15.26
Mt. Taylor	1,334.07	557.61	41.80
San Mateo	2,062.28	1,422.68	68.99
Sandia	2,411.49	480.36	19.92
Zuni	9,795.29	2,535.12	25.88
Total	28,587.95	7,569.48	26.48

HUC = hydrologic unit code

Perennial Streams

There are 6,204.4 miles of mapped stream channels (USGS 2010) in the plan area; 24.8 miles are perennial and 844.7 miles are intermittent. There are far less perennial streams than springs in the plan area (USDA Forest Service 2015a).

No perennial streams occur in the Datil Mountains, Magdalena Mountains, and Gallinas Mountains Geographic Areas. The risk to perennial streams is high in the Manzano Mountains geographic area due to the presence of a single perennial stream. There is a moderate risk for the ecological integrity of perennial streams in the remaining geographic areas. While the perennial streams are rare, they are to some degree distributed across the landscape on these mountain units. In addition, there are perennial streams outside of the plan area which reduces the risk to moderate.

Springs

There are 367 springs within the plan area. Some areas have more springs than others. There are only 3 springs in the Gallinas Mountains, while the Manzanos have 84 springs. The character of the springs is not well known. It is likely many of these springs are dry or only flow for short periods of time, or flow in high precipitation years. The Mt Taylor, Zuni Mountains, Bear Mountains, and Gallinas Mountains geographic areas all have a high risk to the ecological integrity of springs while the remaining four mountain units have a moderate rating. Springs are uncommon—they tend to cluster in areas where hydrogeological conditions are favorable, leading to an uneven distribution across many areas. High risk ratings are largely due to low redundancy combined with nonrepresentative distributions. A more even distribution of springs inside and outside the plan area leads to a moderate rating.

Currently, of these 367 springs, over 80 percent of these springs have been developed for livestock use. Additional springs have been developed for drinking water and wildlife use. When springs are developed, the spring ecosystem is usually not maintained based on results of the ongoing spring inventory and field visits to springs by Cibola National Forest personnel. Using GIS and available data, it is estimated that less than 10 percent of the springs within the plan area have intact ecosystems.

In 2012, 49 springs were inventoried for characteristics and condition. This includes 19 springs on the Sandia Ranger District. Of these springs, four were dry. On the Mount Taylor Ranger District, 30 springs were assessed in the Zuni Mountains, and 19 were dry at the time of the site visit. In the Zunis, Agua Remora is being monitored more extensively due to its importance to the Zuni bluehead sucker.

Wetlands

There are several outstanding national resource waters, as designated by New Mexico Environment Department, within the plan area (table 84). All are within the Apache Kid Wilderness in the San Mateo Mountains on the Magdalena Ranger District. These waters include streams and wetlands. Smith Canyon and Indian Creek have been designated as outstanding national resource waters streams. These segments are 1.4 miles each, for a total of 2.8 miles. Sixteen areas within the Apache Kid Wilderness have been designated as outstanding national resource waters wetlands, totaling 21.9 acres. Nonpoint sources of pollution in these areas must be minimized and controlled through the use of best management practices.

Table 84. Key water resources for wildlife, condition, and trend on the Cibola National Forest

Resource Type	Reference Conditions	Current Trend	Future Trend
Perennial Streams	Proper functioning condition	At risk	Varies with continued at risk condition
Springs and Seeps	Proper functioning condition	At risk to nonfunctioning	Decrease
Riparian/Wetland Areas	Proper functioning condition	At risk	Varies
Waterbodies	Proper functioning condition	At risk	Decrease

Riparian-wetland areas are functioning properly when adequate vegetation, land form, or woody material is present to dissipate stream energy during high flows, filter sediment, capture bedloads, aid in floodplain development, improve flood-water retention and groundwater recharge, develop root masses that stabilize streambanks, and develop diverse characteristics which provide habitat to support greater biodiversity within their potential to achieve this condition (Prichard et al. 1998).

Special Habitat Features

Many species are also associated with ecological conditions consisting of special habitat features not necessarily captured by the more coarse vegetation type descriptions. In these cases, those special habitat features were recorded and assessed separately from the vegetation type model (table 82). In this section, we examine the integrity of special habitat features in terms of associated and potentially affected wildlife and plant species, representing one component of the 'coarse filter' approach described earlier. Special habitat features refer to unique or very specific habitat elements that are not described as individual ecosystems in this document, but rather key components that can occur across multiple ecosystems and provide for the persistence of certain species.

Snags and Coarse Woody Material

Snags (standing dead trees) and coarse woody material (for example, downed logs) serve important ecological functions. They contribute to biological richness as substrate, cavity sites, foraging sites, and shelter or cover (Bunnell et al. 2002). Both provide wildlife habitat and contribute to the formation of soil organic matter, and coarse woody material helps to reduce soil erosion by shielding the soil surface from raindrop impact and interrupting rill and sheet erosion. They provide shelter and food, and retain moisture for forest floor dwelling species. When a large tree falls, it becomes coarse woody material and provides habitat for small animals and insects. When logs rot, they store water and provide nutrients for the continued growth of the forest. Dead wood rotting on the forest floor eventually gets incorporated into the soil. This underground wood feeds many insects and bacteria which provide nitrogen to feed trees and other plants in the forest.

Coarse woody material is not only limited to upland habitats, it has significant impact on riparian areas as well and many aquatic species depend on downed woody material and is a key contributing factor in the maintenance of proper functioning aquatic ecological conditions. Coarse woody material not only provides foraging and escape cover for fish but it contributes to the creation of optimum aquatic ecological condition by slowing down water and contributing to pool development. If the amount of coarse woody material (coarse woody material load, measured in tons per acre) is moderate or high risk of departure from desired conditions, there may be significant negative impacts to species (Siitonen 2001). If coarse woody material is not in adequate supply or below desired conditions, it may result in lack of prey items for some bird and mammals (Bull 2002). When coarse woody material is in excess or above desired conditions it may create unfavorable soil conditions for some plant species by prohibiting growth or germination. This in turn may result in more intense fires that negatively impact soil conditions. Desired conditions for coarse woody material loads should provide optimum ecological condition for terrestrial and aquatic animal species as well as soil conditions for plant species.

Snags are somewhat more transient on the landscape and as snags fall down and eventually decay, standing live trees die becoming new snags. Standing snags of sufficient size for roosting, nesting, or foraging are another special habitat feature departed from reference conditions. If the seral stage proportions of most vegetation types trend towards smaller diameter trees, future trees may not be large enough to provide the habitat required by birds and other species that depend on large diameter trees and snags. Ecologically, a dead tree is as important to the forest ecosystem as a live one (Franklin et al. 1987) and, according to Marcot (2002), provides several key ecological functions that influence the ecosystem. Snags provide homes for birds and foraging opportunities for insectivorous animals. If snags are not in adequate supply or below desired conditions it may result in lack of nesting and foraging sites for birds and mammals. Conversely, large-scale fire often results in too many snags per acre and not enough live trees.

Vegetation communities with high risk of departure from desired snag density conditions are likely to provide poorer ecological conditions for wildlife species that need them, while vegetation communities with low risk of departure from desired snag density conditions are likely to provide better ecological conditions. Snags and coarse woody material are generally at desirable levels across the Cibola. See snags and coarse woody material in chapter 2 of the "Vegetation" section of the assessment (USDA Forest Service 2015a) for more information and the "Vegetation" section of this document for more detailed information.

Abiotic and Rocky Features (canyons, cliffs, crevices, mines, caves, rocky outcrops).

Rock outcrops and cliffs are described in the assessment but not specifically assessed due to limited information regarding their extent in the plan area. Acres of escape terrain (for example, cliffs and rocky features) were not specifically analyzed but presumably this number remains largely unchanged from the reference condition and will continue to remain unchanged. Threats to species dependent upon rocks and outcrops are difficult to quantify. Recreational rock climbing may be the biggest threat to species that use rocky features due to the harassment (intentional or incidental) of wildlife, and the removal of vegetation from cracks and crevices in order to secure handholds and fall-protection equipment. There is an active peregrine nest in the Sandias, but the forest has closure orders to keep people from climbing in those areas. Recreational caving, mining, construction, and vandalism are all activities that can disturb nesting or roosting species and cause direct damage to habitat.

The amount of cliff, cave, and cave-like habitat is not expected to change; management activities would not substantially affect cliff, cave, or cave-like structures, although outside factors (see next section, below) could negatively affect their status. Improper closure of caves or mines can eliminate access to roosting habitat and potentially trap bats if timing is not appropriate (Pierson and Rainey 1998, Gruver and Keinath 2006). Conversely, mine closures if adequately gated can provide increased roosting habitat. The use of rock outcrops for road building materials and locatable minerals could lead to the loss of habitat for plant species tied to specific rock outcrops, soil types, or both. The barren shale slopes of the Chinle formation that Svinski's fleabane inhabits can be attractive to unauthorized off-road vehicle use. Off road vehicle activity can also threaten populations when vehicles travel through populations, crushing and uprooting plants, and possible introducing invasive species.

Functional and Structural Connectivity

Near-natural rates of movement are desired across the landscape for wildlife. However, the current condition is altered by departure in vegetation structural state as well as human-made features (for example, roads).

Connectivity is important for both terrestrial and aquatic species. It connects adjacent habitat and promotes healthy movement of animals between foraging and wintering grounds, as well as genetic flow between populations. Connectivity can occur at different spatial scales and among similar and different habitat patches. It is reduced by habitat fragmentation which can be caused by natural (for example, wildfire) or unnatural processes (for example, human development). An animal's ability to move between optimal habitats is important in evaluating how well it responds to such disturbances over time. Prior to 1890, there were no real barriers to animal movement in the southwest. Since that time there has been phenomenal population growth.

All major vegetation types on the Cibola were analyzed for mean patch size during the assessment. All Cibola forest and woodland types are currently highly departed from reference conditions because of uncharacteristically large patch size and are considered to be at high risk from wildfire. In contrast, all grassland and most shrubland system types are highly departed because of small patch size and considered to be at high risk. The same phenomena responsible for increasing patch size of forests and woodlands (removal of fine fuels, fire suppression) are responsible for decreasing patch size of shrublands and grasslands due to tree encroachment. Under historic fire regimes, trees establishing in a shrubland or grassland would have been periodically killed by wildfire, maintaining these historically treeless system types.

Additional Risk Factors

This section describes risk factors shared by at-risk species and other species of interest on the Cibola representing the species-specific level of analysis as described earlier. Some risk factors directly affect the species while others affect the species' habitat. Additionally, some risk factors exist independent of the habitat condition (for example, livestock grazing, and timber harvest), whereas the severity of some risk factors may be amplified by poor habitat conditions (for example, spread of invasive plants in disturbed areas).

Vegetation Management

Large trees are rare on the landscape as a result of past management (for example, fire suppression, even-aged management) and overstocking. While density reduction will ultimately promote diameter growth, reduced risk, and desired structure over the long term, restoration treatments have the potential to remove some key structural elements. This could have short-term impacts on species associated with these elements (for example, loss of potential nesting, roosting, foraging trees). In addition to animal species, at-risk plant species could be impacted by ground disturbance from fuels reduction treatments, as well as herbicide application, especially herbicide applications that might be designed to favor grazing by reducing broadleaved plants and favoring grass and sedge species.

Stand-replacement fire could impact species that require dense cover or large trees. Depending on the timing, fire (natural or prescribed) could also disrupt nesting. Burning at high intensities in wildfires can damage seed banks and mycorrhizal networks and lead to soil loss. Suppression activities can increase the chance of subsequent invasion by nonnative species, while also directly impacting plant populations when fire line is built through plant occurrences. Conversely, fire suppression in ecosystems where frequent fire is part of the natural disturbance regime may be a risk factor for species that are fire-adapted. In riparian systems, ash deposition resulting from large fires can have negative effects on aquatic species that occur downstream.

Hydrologic Alteration

The biggest threat to riparian vegetation in the plan area is lack of natural flooding. A properly operating hydrologic regime is defined by the magnitude, frequency, and timing of runoff from a watershed and is essential to maintaining ecosystem integrity of aquatic, riparian, and wetland ecosystems. In riparian systems, the most important aspect of the hydrologic regime is flooding, including annual and inter-annual variability in flooding, as well as sediment erosion and deposition. Marshes and wet meadows are driven by periodically deep water along with periodic drought. Human alteration of the natural flow regime (for example, dam construction, water diversions, ditches, groundwater pumping) disrupts the dynamic equilibrium between the movement of water and the movement of sediment that exists in free-flowing rivers (Dunne and Leopold 1978).

This alteration can change the composition, structure, function, or a combination of these things of riparian and wetland ecosystems (Bain et al. 1988) and have detrimental impacts on species that occur in this ecosystems. Thus, diversions and groundwater pumping can reduce the amount of water in riparian ecosystems and associated water tables, impacting habitat over the short and long term, by removing water which is necessary to recharges surface water features. Lack of natural flooding and lowering of water tables can lead to loss of native seedling recruitment, vegetation structure and composition, and slow radial tree growth.

Roads and road construction also contribute sediment to the watershed/ altering natural sediment and hydrologic regimes through changes to streamflow patterns and amounts, sediment loading, transport, deposition, channel morphology and stability, and water quality and riparian conditions within a watershed (Jones et al. 2000, Trombulak and Frissell 2000, Al-Chokhachy et al. 2016). Roads can contribute as much as eighty percent of the sediment that enters streams (Hagans et al.1986). Morrison (1975) found forests with roads can deliver a sediment load 300 times greater than on undisturbed forest land. Thus, sediment delivery to stream channels via forest roads can be a primary source of water quality and aquatic habitat degradation.

Unauthorized Livestock and Wildlife Grazing, Browsing, Trampling

Livestock and wildlife grazing can impact different species in different ways. The more relevant impacts for at-risk species assessed in this document include direct impacts to at-risk plant species from browsing and trampling, increased erosion, changes in plant species composition, reduction of stubble height, woody recruitment and herbaceous ground cover, and disease transmission (domestic sheep and bighorn sheep). Overgrazing has been a significant historical factor in the modification and loss of riparian habitat in particular, in the west. Overutilization and trampling can alter plant community structure, species composition, relative abundance of species, vegetative density, and alter stream channel morphology.

Riparian and wetland areas are especially vulnerable to increased sedimentation or hydrologic alteration that can be associated with improper grazing or uncharacteristically high use by wild ungulates. Species that occur on highly erodible soils may also be impacted by high levels of ungulate use and associated atypical rates of erosion. Refer to the “Water” and “Rangeland Resources” sections for more information on range management and associated conditions and trends on the Cibola.

Nonnative Invasive Species

Invasive plants can have serious ecological impacts by altering plant species composition that reduces biodiversity and ecosystem resilience, by changing the natural fire regime and reducing hydrological flow and output. Climate change is expected to increase the impacts of invasive plant species by causing them to increase and expand. Control of invasive species can also have negative impacts on at-risk species. For example, herbicides could be applied to undiscovered occurrences of at-risk plant species, and result in direct mortality to individuals. Native species that grow in disturbed roadside areas may have population declines due to herbicide spraying. For more information, see the “Invasive Plants” section. Because the distribution of the Zuni bluehead sucker is so isolated and its habitat so restricted, introduction of certain nonnative species into its habitat could be devastating (Federal Register 2016). Potentially harmful nonnative species include green sunfish (*Lepomis cyanellus*), northern crayfish (*Orconectes virilism*), fathead minnow (*Pimephales promelas*), and other nonnative fish eating (piscivorous) fish (Federal Register 2016).

Disease

Chytrid fungus is major contributing factor to the decline of amphibians. A fungal infection, chytrid is caused by the flagellated zoospore *Batrachochytrium dendrobatidis* (Daszak et al. 2000). Chytrid can be transmitted from host to host through direct contact (territorial or breeding encounters), movement of surface water, in damp or moist soil and in laboratory tests it has been found to live on the feathers of birds, especially waterfowl, long enough to be transported between waterbodies (Johnson and Speare 2003, 2005). Although mammalian body temperatures preclude *Batrachochytrium dendrobatidis* infection both migrating aquatic and terrestrial mammals may serve as vectors of this disease. It is currently not known how prevalent this disease may be on the Cibola but it is a primary risk factor for Chiricahua leopard frog.

Sylvatic plague, a disease foreign to the evolutionary history of prairie dogs, and mortality is often 100 percent (U.S. Fish and Wildlife Service 2009; Cully et al. 2006). According to the U.S. Fish and Wildlife Service (2009), "Sylvatic plague remains a significant population stressor and the spread and effects of plague on the species [prairie dog] could be exacerbated by climate change in the future." The unpredictable nature of plague and its devastating mortality inhibits efforts to manage for prairie dogs (Cully et al. 2006) and their associated species. For example, in Wyoming, the extent of prairie dog habitat used by nesting mountain plovers is directly affected by plague-driven fluctuations in the extent of active prairie dog colonies (Augustine et al. 2008).

White-nose syndrome is a highly-contagious infection of hibernating bats, and it has been associated with massive mortality of cave-hibernating bat species in the northeastern United States (Blehart et al. 2009). This disease has rapidly spread throughout the eastern United States and Canada since its discovery in 2006 and was discovered in Washington State in March of 2016 (Lorch et al. 2016, Sleeman 2016).

White-nose syndrome has been confirmed in 33 states and seven Canadian provinces, mainly in the East and Midwest. The first case in the West was documented in Washington State in 2016 (Lorch et al. 2016; Bat Conservation International 2018). Recent detections of *Pseudogymnoascus destructans* in Texas and Wyoming and the confirmation of white-nose syndrome in Oklahoma and South Dakota have prompted federal lands managers in New Mexico to elevate precautions to protect bats in caves and abandoned mines; a recent report by Bureau of Land Management and National Park Service suggests *P. destructans* has likely been found in New Mexico. Among the locations in New Mexico taking additional decontamination or access measures are Carlsbad Caverns National Park and El Malpais National Monument, Fort Stanton Cave in Lincoln County, and Cottonwood Cave in Lincoln National Forest (BLM 2018). If white-nose syndrome is introduced, the impact to bat populations could be extensive. There are more than 2,100 natural caves and thousands more abandoned mines in New Mexico; bats are at potential risk of infection if people spread or track microscopic spores of the fungus *P. destructans* into or out of caves and mines (Bureau of Land Management 2018). Although unknown at this time, white-nose syndrome could have significant negative impacts to species like Townsend's big-eared bats if it becomes established in the plan area. In the past, bat species which have been hardest hit by white-nose syndrome were characterized by colonies with large clustering behavior and caves with higher humidity levels (Marroquin et al. 2017). Townsend's bat tend to roost alone or in small clusters which may put it less at risk from the potential threat of white-nose syndrome. However, a recent article published in Nature (Hoyt et al. 2018) highlights evidence for intercommunity transmission between different bat species, regardless of roosting behavior.

Epizootic pneumonia, caused by *Mycoplasma ocipneumoniae* (*M. ovican*) can cause respiratory disease and die-offs in bighorn sheep (Besser et al. 2008, Besser et al. 2014). This is the primary risk factor affecting persistence of bighorn sheep in the plan area. Possible intermingling between sheep on the Cibola and private herds on adjacent lands could be a risk factor if left unchecked. To date, however, there have not been any documented cases of pneumonia on the Cibola.

Climate Change

Climate change has occurred to some degree and will continue in the future. Ramifications of a changing climate on wildlife are likely to include reduced snowfall or earlier snow melt in the spring, extended periods of drought or extended dry periods in the spring and summer, more frequent and larger wildfires, increased bark beetle mortality, and changes in site characteristics that promote type conversion or vegetation community changes. This pattern is consistent with current trends in other parts of the West (Stephens et al. 2018).

These changes cause seasonal ranges and food sources for wildlife to shift and can affect the timing of reproduction. Reduced snowpack and changes in precipitation can affect amphibians by reducing water levels in lakes and ponds, as well as affect species that rely on deep or persistent snow. Forested tracts and remote habitats can also become isolated, reducing landscape connectivity and habitat for species with limited dispersal ability. The timing of spring green up can also affect food availability for migratory birds or forage conditions for big game. Those species with highly specialized habitat requirements, at the edge of their range, currently in decline, and or having poor dispersal abilities may be particularly at risk.

For example, climate variability has been shown to affect colonization and persistence dynamics in amphibians, with more severe winters positively affecting species in western montane sites. In western dry and montane areas, snow water equivalent, winter severity, and water availability are strong predictors of higher occupancy rates (Miller et al. 2018).

Climate change is the primary risk identified for most at-risk species in the New Mexico Rare Plant Conservation Strategy (EMNRD-Forestry Division 2017). The strategy states, “Climate change is not only expected to affect species directly, but also to have significant impacts on their habitats and the ecological systems on which they depend. This is likely to exacerbate the effects of other human activities on plants. Impacts associated with climate change include prolonged droughts, increased fire frequency and severity—including severe habitat alteration caused by megafires—and increases in invasive species (plants and animals); all of these can alter associated plant communities. The impacts are especially significant for small populations with restricted ranges, including many of the species endemic to New Mexico.”

Recreational Shooting

Recreational shooting of prairie dogs can depress prairie dog colony productivity and health, fragment populations, and can reduce recovery of colonies from plague (Luce 2006). Shooting of prairie dogs can also reduce population densities, diminish body condition and reproduction, cause behavioral changes, and increase emigration (U.S. Fish and Wildlife Service 2009). Nontarget scavengers and predators have an increased potential for lead poisoning from consuming prairie dogs containing lead shot (Pauli 2005; U.S. Fish and Wildlife Service 2009).

Small and Isolated Populations

Small and isolated populations are susceptible to threats from genetic drift and stochastic events. This alone is not necessarily enough to substantiate local concern for continued persistence on the Cibola but does contribute to concern, particularly when the species is known to be impacted by other risk factors. This is a risk factor for local endemics or species with limited or restricted ranges like Chiricahua leopard frog, Dumont's fairy shrimp, Alamosa springsnail, Zuni milkvetch, villous groundcover milkvetch, Sivinski's fleabane, Sandia Mountain alumroot, and Zuni fleabane.

Critical Habitat for Listed Species

Section 7 of the Endangered Species Act requires Federal agencies to ensure that actions they authorize, fund, or carry out are not likely to destroy or adversely modify designated critical habitat. Mexican spotted owl, Chiricahua leopard frog, and Zuni bluehead sucker have designated critical habitat either on, or close to, the Cibola National Forest. Southwestern willow flycatcher has designated critical habitat, and yellow-billed cuckoo has proposed critical habitat near but not on the Cibola.

Mexican Spotted Owl

On August 31, 2004, U.S. Fish and Wildlife Service personnel designated approximately 8.6 million acres of critical habitat for the Mexican spotted owl on Federal lands in Arizona, Colorado, New Mexico, and Utah (69 Federal Register 53181). Within the critical habitat boundaries, critical habitat includes only protected and restricted habitats as defined in the original recovery plan (U.S. Fish and Wildlife Service 1995). It also excludes 157 wildland-urban interface project areas on National Forest System lands. Similarly, the primary constituent elements of critical habitat were listed as those habitat features recognized in the 1995 recovery plan as associated with Mexican spotted owl occupancy.

There are twenty critical habitat units in the state of New Mexico, for a total of 2,089,523 acres. Forest Service staff manages the majority of that land (2,056,536). On the Cibola National Forest, there are approximately 435,100 acres of designated critical habitat within all four mountain units. This acreage is within six critical habitat units within the Upper Gila Mountains, Basin and Range East, and Colorado Plateau Recovery Units (table 85). These areas encompass habitat that contains primary constituent elements, including mixed conifer and pine-oak forest types, canyons and cliffs, and riparian areas required for survival by the Mexican spotted owl. As defined in the 1995 recovery plan (U.S. Fish and Wildlife Service 1995), protected and restricted habitat was used as the basis for critical habitat definition. Protected areas include protected activity centers, areas in mixed conifer and pine-oak with greater than 40 percent slopes where timber harvest hasn't occurred in the past 20 years, and administratively reserved lands such as wilderness areas or research natural areas. Several designated areas contain Mexican spotted owl designated critical habitat. These include the Withington Wilderness, Apache Kid Wilderness, and Langmuir Research Site (Magdalena Mountains) on the Magdalena Ranger District; the Manzano Mountain Wilderness on the Mountainair Ranger District; and the Sandia Mountain Wilderness on the Sandia Ranger District. See the forestwide assessment, volume 2, figures 81 to 83 for additional information on designated areas (USDA Forest Service 2015b).

Restricted habitat includes mixed conifer, pine-oak, and riparian forests outside of protected activity centers. While a variety of vegetation types are within the boundaries of the critical habitat designation (table 85), mixed conifer, pine-oak, and riparian forest provide the primary constituent elements necessary for owl habitat.

Table 85. Critical habitat unit acreages on the Cibola by ranger district, geographic area, and wilderness

Critical Habitat Unit Name	Ranger District	Geographic Area	Total subunit Acres Cibola	Total Subunit Acres, Cibola Wilderness
UGM-3	Magdalena	San Mateo Mountains	135,869	57,502
UGM-2	Magdalena	Magdalena Mountains	34,189	0
BR-E-5	Mountainair	Manzano Mountains	26,043	25,263
BR-E-7	Sandia	Sandia Mountains	3,588	3,557
CP-1	Mt. Taylor	Mt Taylor	32,9798	0
CP-2	Mt. Taylor	Zuni Mountains	203,191	0
Total acres			435,678	NA

UGM = Upper Gila Mountains; BR-E = Basin and Range East; CP = Colorado Plateau

The Cibola National Forest GIS was used to calculate the amount of Mexican spotted owl recovery area on the Cibola—approximately 424,845 acres. The Mexican spotted owl recovery area within critical habitat is estimated at 251,271 acres, and the Mexican spotted owl recovery area that occurs outside designated critical habitat is estimated to be 173,574 acres (see map packet).

Chiricahua Leopard Frog

The U.S. Fish and Wildlife Service proposed critical habitat for the Chiricahua leopard frog in March 2011 (U.S. Fish and Wildlife Service 2011a). Final critical habitat became effective on April 19, 2012 (U.S. Fish and Wildlife Service 2012). The Chiricahua leopard frog recovery plan (U.S. Fish and Wildlife Service 2007) identifies eight recovery units. Recovery unit eight includes a small part of the San Mateo Mountains and one critical habitat unit (Unit 35), the Alamosa Warm Springs, is located on private land just off the Cibola National Forest boundary (approximately 0.7 miles away). This was designated as critical habitat because it contains primary constituent elements for the frog which include aquatic breeding habitat and immediately adjacent uplands for foraging and basking that are required for its survival.

Zuni Bluehead Sucker

On June 6, 2016 critical habitat for Zuni bluehead sucker was designated. A total of 12.1 miles of critical habitat are on the Cibola (table 86).

Table 86. Critical habitat unit mileages on the Mt. Taylor Ranger District, Zuni Mountains Geographic Area

Name of Waterbody	Miles on the Cibola
Agua Remora	4.1
Cebolla Creek*	4.0
Rio Nutria	2.6
Tampico Draw	1.4

*Cebolla Creek was unoccupied habitat at the time of critical habitat designation

Southwestern Willow Flycatcher

The U.S. Fish and Wildlife Service designated stream segments in 24 management units found in six recovery units as critical habitat for the southwestern willow flycatcher (U.S. Fish and Wildlife Service 2013). There is currently no critical habitat designated for flycatcher on the Cibola National Forest; however, Recovery Unit 52 occurs on the Middle Rio Grande and runs between the Mountainair Ranger District (Manzano Mountains) on the north and the Magdalena Ranger District (San Mateo Mountains) on the south part of the Cibola for approximately 95 miles. At its closest point, critical habitat for the southwestern willow flycatcher is approximately 9 miles from the southeastern portion of the San Mateo Mountains (Magdalena Ranger District).

Yellow-Billed cuckoo

The U.S. Fish and Wildlife Service proposed 80 units as critical habitat for the western distinct population segment of the yellow-billed cuckoo in August, 2014 (U.S. Fish and Wildlife Service 2014). There are no critical habitat units currently proposed on the Cibola; however adjacent habitat exists on the Rio Grande (Middle Rio Grande, Unit 52), starting near the southern part of the San Mateo Mountains (Magdalena Ranger District) and running north well past the Sandias and the Cibola boundary. The portion of habitat between the San Mateo Mountains and Sandia Mountains also overlaps with critical habitat for southwestern willow flycatcher (see above). At its closest point, proposed critical habitat for cuckoo comes within approximately 2.4 miles of the northwestern portion of the Sandia Mountains (Sandia Ranger District) as it continues north past the Cibola National Forest boundary.

Amount of Occupied Habitat and Unoccupied Habitat for Listed and Sensitive Species

Listed Species

Mexican wolf (*Canis lupus baileyi*) was historically extirpated from nearly all its range in the United States and has been reintroduced to the American Southwest since 1998. It is federally endangered. Though the species does not currently breed or den on the Cibola, it has been documented foraging on the Cibola a number of times with detections on the Magdalena Ranger District (Bear Mountains and San Mateo Mountains; Game Management Units 13 and 17) and Mount Taylor Ranger District.

Mexican spotted owls (*Strix occidentalis lucida*) are well known on Mt. Taylor, Magdalena, Mountainair, and Sandia Ranger Districts. There are currently 95 protected activity centers spread across the Cibola; this represents 46,344 acres of protected habitat (table 87). Within this amount, there are approximately 5,218 acres of nest or roost (core) habitat currently occupied.

Table 87. Mexican spotted owl habitat acres occupied on the Cibola

Habitat Designation	Mt. Taylor Ranger District	Magdalena Ranger District	Sandia Ranger District	Mountainair Ranger District	Total Acres
Protected habitat (PACS)	18,474	25,834	1,180	855	46, 344
Core (nest and roost)	210	4,904	105	0	5,218

PACs = protected activity centers

Unoccupied habitat for the owl is defined as recovery habitat using the habitat definition in the revised recovery plan (U.S. Fish and Wildlife Service 2012b). It is estimated there are 251,271 acres of recovery habitat on the Cibola (Dry Mixed Conifer, Ponderosa Pine Forest (pine-oak), riparian) within critical habitat and 173, 574 acres outside critical habitat for a total of 424,845 acres.

Using data from the vegetation analyses (see "Vegetation" section, USDA Forest Service 2018) it is possible to calculate the amount of habitat on the Cibola National Forest in the primary vegetation types used by the owl that likely contains potential nesting and roosting habitat (characterized by larger trees and closed canopy). There are an estimated 50,517 acres within the Mixed Conifer Frequent Fire and Ponderosa Pine Forest (pine-oak) vegetation types that contain this type of habitat.

Sensitive Species

There are 14 sensitive species currently known to occur on the Cibola spread across all 4 ranger districts. Sensitive species are associated with 11 distinct vegetation types as well as aquatic habitat and caves and rocky features. Table 88, table 89, and table 90 show the districts where each species is known to occur, the amount of habitat potentially available by vegetation types, and the amount of habitat occupied (if known) for each species. Occupied habitat is a subset of the total acreage for each vegetation types, or stream miles for aquatic sensitive species. Information in the tables is derived from the ecological assessment (USDA Forest Service 2015a), Cibola National Forest GIS files, the Natural Resource Manager (NRM) system which is the database of record for Forest Service and the VDDT model runs from the vegetation analysis (See the "Vegetation" section for more information on VDDT models).

Table 88. Sensitive species, district(s) they occur on and amount of habitat occupied if known

Species	District of occurrence	Vegetation Types or habitat features[49]	Acres or Amount of Occupied Habitat	Potentially suitable habitat in each vegetation type or number of features forest-wide.
Northern leopard frog	Mt. Taylor Magdalena, Sandia (Mountainair suspect)	Riparian, unspecified aquatic, standing water	Unknown	7,578 367 springs
Northern goshawk	All	DMC (157,234) MCW (32,942) PPF (455,546) SFF (7,775)	16,576 (PFAs)[50]	653,497 60,588 acres nesting, roosting, post fledging.
American peregrine falcon	All	MCW (32,942) PJW (266,293) PPF (454,546) SFF (7,775) Cliffs and rocky features	Unknown	761,556 Unknown number of cliffs and rocky features
Bald eagle	All	Riparian PPF (454,546)	Unknown	7,578 Riparian 173,077 PPF (optimal)
Burrowing owl	Magdalena	CDS (590) JUG (92,596) SAGE (2,658) SDG (113,965)	161,673	209,809 73 prairie dog colonies

[49] SFF=Spruce fir forest; MCW=Mixed conifer with aspen; DMC=Mixed conifer frequent fire; PPF=Ponderosa pine forest; PJC=Pinyon juniper evergreen shrub; PJO=Pinyon juniper woodland; PJG=Pinyon juniper grass; JUG=Juniper grass; MPO=Madrean pinyon oak woodland; MSG=Montane/alpine grassland; CPGB=Colorado Plateau/Great Basin grassland; SDG=Semi-desert grassland; MMS=Mountain mahogany mixed shrubland; GAMB=Gambel oak shrubland; SAGE=Sagebrush shrubland; ISS=Intermountain salt scrub; CSDS=Chihuahuan slat desert scrub; CDS=Chihuahuan desert scrub; SAND=Sandsage

[50] Post-fledging family area

Species	District of occurrence	Vegetation Types or habitat features[49]	Acres or Amount of Occupied Habitat	Potentially suitable habitat in each vegetation type or number of features forest-wide.
Gray vireo	Magdalena Sandia (Mountainair suspect)	JUG (92,596) MMS (18,007) PJO (266,293)	Unknown	376,896
Spotted bat	Mt. Taylor, Magdalena (Sandia, Mountainair suspect)	SAGE (2,658) SDG (113,965) MSG (41,519) CPGB (24,094) Rocky outcrops, caves/mines and aquatic features	Unknown	182, 236 21 adits (Sandia) 49 abandoned mines (Mt. Taylor-Zuni Mountains) 2 significant caves
Allen's lappet browed bat	Magdalena	PPF (454,546) DMC (157,234) Rocky outcrops, caves mines and aquatic features	Unknown	611,780 223,707 (optimal) 21 adits (Sandia) 49 abandoned mines (Mt. Taylor-Zuni Mountains) 2 significant caves
Pale Townsend's big-eared bat	All	CDS (589) PJW (266,031) Rocky outcrops, caves mines and aquatic features	Unknown	266,620 21 adits (Sandia) 49 abandoned mines (Mt. Taylor-Zuni Mountains) 2 significant caves
Gunnison's prairie dog	Mt. Taylor, Magdalena Mountainair	CDS (590) JUG (92,596) SAGE (2,658) SDG (113,965)	207,809 73 colonies (3056 acres)	221,184
Magdalena mountain snail	Magdalena	Igneous stone, leaf litter, moisture	Known from 2 sites	Unknown
Dumont's fairy shrimp	Mt. Taylor	Unspecified aquatic (standing water)	Known from 2 stock tanks	129 tanks or developed springs (42 stock/range)

Table 89. Sensitive plant species, district(s) they occur on and amount of habitat occupied if known

Species	District of occurrence	Vegetation types, or habitat features	Acres or Amount of Occupied Habitat
Villous groundcover milkvetch	Magdalena	Ponderosa Pine Forest Rocks features PPF (455,546)	Unknown
Sandia Mountain alumroot	Sandia, and Mountainair	Mixed conifer-aspen Rocks and soil features DMC (157,234) MCW (32,942)	Unknown
Sivinski's fleabane	Mt. Taylor	Colorado Plateau/Great Basin Grassland and PJ Woodland (266,293) Cliffs and rocky features	Unknown
Zuni milkvetch	Mt. Taylor and Magdalena	PJ woodland (266,293)	Unknown

Table 90. Sensitive fish species, district(s) they occur on and amount of habitat occupied if known

Species	District of occurrence	HUC 6 Watershed	Miles of Occupied Habitat
Rio Grande sucker	Mt. Taylor	Agua Medio-Bluewater creek	1 mile or less
Rio Grande chub	Mt. Taylor	Agua Medio-Bluewater creek	1 mile or less

Environmental Consequences

Methodology and Analysis Process

Habitat Relationships: Ecosystem and Species-Specific (coarse filter/fine-filter)

Under the National Forest Management Act (NFMA, 16 U.S.C. 1604(g)(3)(B)), the Forest Service personnel are directed to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet multiple-use objectives, and within the multiple-use objectives of a land management plan adopted pursuant to this section [of this Act], provide, where appropriate, to the degree practicable, for steps to be taken to preserve the diversity of tree species similar to that existing in the region controlled by the plan." To meet this objective, the 2012 Planning Rule adopts a complementary ecosystem and species-specific approach to maintaining the diversity of plant and animal communities and the persistence of native species in the plan area, commonly known as a coarse-filter/fine-filter approach to maintaining species diversity (36 CFR 219.9). The analysis of ecological conditions emphasizes vegetation conditions important to wildlife and plants because many species are strongly tied to individual vegetation type's structure, composition, and function (for example, ecological integrity). The analysis presented assumes that species sustainability is best modeled by using what scientific literature designates as typical habitat for a species. A combination of ecosystem (coarse filter) and species-specific (fine filter) conditions are considered and this approach assumes that if the species, genetics, functions and processes are protected at the community level, then the bulk of the biotic species, both known and unknown, will also be protected. However, for a subset of at-risk species within the plan area, additional conservation emphasis (for example, plan components) will help to ensure rarer species will also persist on the landscape (219.9(b)(1). The ecosystem and species-specific process is described in detail in chapter 7 of the ecological assessment (USDA Forest Service 2015a).

Land management plans are developed to guide the maintenance or restoration of structure, function, composition, and connectivity of ecosystems to provide ecological conditions that will maintain a diversity of plant and animal communities and support the persistence of most native species in the plan area. This analysis focuses on evaluating the consequences of the plan alternatives on at-risk species. Forest Service at-risk species include two categories: (1) federally designated species and habitat (species listed as threatened or endangered, species that are proposed or candidates for federal listing, and species with designated critical habitat on the national forests), and (2) Forest-Service-designated species of conservation concern. Forest Service Southwestern Region sensitive species were also analyzed.

The basis for the analysis requires a determination of whether plan components such as desired conditions, objectives, standards, and guidelines provide direction to provide the ecological conditions necessary to contribute to the recovery of federally recognized species and maintain or restore the ecological conditions necessary to maintain persistence of species of conservation concern within the plan area. Plan components were developed in an iterative way, which included identifying desired conditions and potential threats to species, and identifying whether proposed plan components are sufficient to address species and their habitat needs (Forest Service Handbook 1909.12 12.52.c-d).

It is also recognized that due to circumstances that are neither within the authority of the Forest Service nor consistent within the inherent capability of the land, the plan area may be unable to provide the ecological conditions necessary to maintain a viable population of a particular species of conservation concern. When this occurs, the draft environmental impact statement documents this and where possible, focuses on other efforts that will contribute to maintaining a viable population of the species within its range (36 CFR 219.9(b)(2)). Further, plan components should provide the ecological conditions to the extent that viable populations of each species of conservation concern exist or will exists in the future. Plan components cannot prevent all adverse impacts to *individual*s of a species but have been designed to provide for viability of the *species* at the plan-level.

Indicators and Measures

Federally Listed Species

The analysis evaluates two primary aspects for federally listed species. First, the adequacy of plan direction in each alternative to protect, maintain, and restore habitat elements identified for species and primary constituent elements of designated critical habitat, and address primary threats to promote recovery of listed species. Second, the adequacy of plan direction to avoid, minimize, or mitigate potential short term adverse effects to federal listed species and candidate species focusing on the relevant threats on the Cibola National Forest to individuals within occupied and critical habitat. The analysis also considers the authority of the Forest Service and the inherent capability of the plan area to provide for federally listed at-risk species. An analysis for the selected alternative will be documented in detail in a biological assessment to be submitted to the U.S. Fish and Wildlife Service and available in the project record.

Species of Conservation Concern

In contrast to categories described above that are derived under the Endangered Species Act, species of conservation concern is a new category developed and used by the Forest Service under the 2012 Planning Rule. It describes animal and plant species known to occur in the plan area and for which the regional forester has determined the best available scientific information indicates substantial concern about the species capability to persist over the long term in the plan area. The species of conservation concern list guides land management planning; however, the designation of these species is not a land management plan decision. Just as there is a process for U.S Fish and Wildlife Service to change the Federal listing status of a species; the regional forester has authority to change species of conservation concern lists to reflect new information. For fish plants, and wildlife species of concern, we describe key ecological conditions and threats that occur on the Cibola National Forest, the plan components that alleviate those threats and a summary of why plan components do or do not provide for viability in the plan area. Plan components will not, and cannot, prevent all adverse impacts to individuals of the species and have been designed to provide for viability of the species at the plan level only. Optional plan language, such as goals and potential management approaches, are included in the narratives where needed and provide vision and strategy for improving ecological conditions for species that lack viability in the plan area because it is either not within the inherent capability of the land or outside Forest Service management authority.

For each species of conservation concern, concern, key ecological conditions and threats that occur on the Cibola National Forest, are described along with the plan components that alleviate those threats and a summary of why plan components do or do not provide for viability in the plan area. Plan components will not, and cannot, prevent all adverse impacts to individuals of the species, and have been designed to provide for viability of the species at the plan-level only. Optional plan language such as potential management approaches are included in the narratives where needed and provide vision and strategy for improving ecological conditions for species that lack viability in the plan area because it is either not within the inherent capability of the land or outside forest service management authority. The species crosswalks (volume 2, appendices E and F) highlight key issues and plan components intended to provide for viability.

Ecological Conditions (Quantity and Quality)

The key indicators for the species analysis are trends (toward or away from reference conditions) in ecological conditions. Primary habitat associations and associated threats are described for each at-risk species. Ecological conditions are evaluated by the potential trend in relative amount and distribution of habitat (for example, vegetation types) in the plan areas over the next 15 years. Ecological conditions are also evaluated by the potential trend in resiliency and ability of habitats to be adaptable to large-scale disturbances (such as wildfire, insect outbreaks, and drought). The natural range of variation for different ecosystems, as described in the assessment (see chapter 2, vegetation), was foundational to the development of plan components, analysis of alternatives, and monitoring plan development. The natural range of variation helps managers to place current conditions into historical context (Swetnam et al. 1999) and highlights the departure from reference conditions and the level of management that may be needed to move a system toward a more desired state. In general, species in ecosystems that are more highly departed from reference conditions will be more at risk than species occurring in systems that have low departures and are more intact.

There are no expected changes in the overall quantity of ecological conditions as a result of the land management plan revision under any alternative during the life of the land management plan. However, the various alternatives affect overall habitat quality, and move ecological conditions toward the desired state at different rates. These indicators were selected because they provide a reasonable assessment of ecological conditions needed to support the persistence of at-risk species and because relative differences among alternatives could be readily compared. Qualitative comparisons were used where quantitative data on habitat was unavailable. The amount of habitat provides a relative measure of habitat condition and extent to maintain species persistence and is also an appropriate measure for a programmatic-level analysis. The condition of habitat is used as an indicator only when it can be estimated adequately at the programmatic-level, such as assessing not only the amount of impact from wildfire but also the type of fire and the resulting effects on habitat quality. Departure of vegetation structure from reference conditions equals departure from fire regime condition class and a corresponding increase in uncharacteristic wildfire, the primary threat facing most species in the plan area.

Management direction that may alleviate or exacerbate threats to habitat are evaluated at a programmatic level. The land management plan does not authorize site-specific projects or activities; therefore there are no direct effects from adopting the land management plan. The direct and indirect site-specific effects will be analyzed when future projects are proposed. Although potential short-term consequences may be described where appropriate from implementing the programmatic approach, this evaluation focused on longer term indirect and cumulative effects that may occur over the 15 year life of the land management plan.

Much of the analysis is based upon the premise that the natural range of variation provides important background information for evaluating ecological integrity and sustainability (Wiens et al. 2012). The natural range of variation was used in development of plan direction (desired conditions) and the selection of indicators and measures for the analysis because the condition and quantity of habitat available to a species helps predict the potential for species distribution and abundance within that habitat. Also important in the analysis of ecological integrity and sustainability of vegetation are consideration of climate and associated fire trends that may be creating a combination of conditions that are outside of the natural range of variation (Millar and Stephenson 2015).

Ecosystem-level plan components (largely centered on desired conditions within the natural range of variation) are expected to provide for ecological conditions necessary to maintain the persistence or contribute to the recovery of native species within the plan area including at-risk species. The ecosystem-level approach is considered the primary context for evaluating at-risk species. Ecosystem-level plan components include desired condition and objective statements that focus on achieving habitat conservation outcomes across the plan area landscape (desired conditions) using concise, measurable, and time-specific statements to guide progress (objectives). Where ecosystem-level plan components would not provide sufficient conditions for one or more at-risk species, species-specific plan components, including standards and guidelines, were incorporated. These fine-filter components (standards and guidelines), are developed to help achieve or maintain the desired condition, to avoid or mitigate undesirable effects, or to meet applicable legal requirements.

The complimentary ecosystem and species specific approach, described in the section above, will provide ecological conditions and viability for the vast majority of species within the plan area and for the diversity of plant and animal communities.

This analysis includes:

- departure and trend of key ecosystem characteristics (vegetation types or other habitat elements defined in the preceding section) needed by each species and how well plan components address that trend (toward or away desired state)
- how well species primary threats are addressed, and key ecological needs are provided for, at the ecosystem level (coarse-filter plan components)
- how well species primary threats and key ecological needs are provided which are not already addressed by the above components (fine-filter, additional plan components that were added to address threats and minimize risk)

Analysis Area

In general, the analysis area for indirect effects includes all lands managed by the Cibola National Forest; however, for the purposes of this document, it may include areas outside the national forest boundary such as critical habitat adjacent to the planning unit which could be affected by forest management. In some cases, the Cibola provides all or a high percentage of the habitat for a given species. However, in most instances, wildlife generally move from area to area, and habitats across multiple land jurisdictions may be important to the overall persistence of the species within its range. Cumulative effects analyses generally include lands within other ownerships immediately adjacent to the national forest including El Malpais National Monument, Acoma Pueblo land, Kirtland Airforce Base, and comparatively smaller sections of State, county, and privately owned lands. For some wide-ranging species, the analysis area was a little larger and included an evaluation of connectivity between larger areas of habitat or interspersed ecosystems.

For species with migratory or travel routes that extend far beyond the Cibola National Forest, management direction under alternatives B, C, and D would only influence habitat persistence (both quantity and condition) within the land management plan areas; actions that occur outside the Cibola National Forest boundary are not within Forest Service management authority. For fish species listed under the Endangered Species Act and species of conservation concern, the analysis area is limited to the Mt. Taylor Ranger District since this is the only area on the Cibola that provides habitat for these fish species.

Assumptions

If a species is associated with a particular vegetation or habitat type, then the condition, amount, and distribution of those habitat elements available to the species on the landscape help to predict its distribution and abundance within that habitat.

Abundance and distribution of ecological condition across the landscape is similar to that which supported associated species during conditions as a consequence of evolutionary time, will likely contribute to their maintenance in the future (Haufler 1999). Therefore, habitat abundance, distribution, and condition similar to that within the natural range of variation for the habitats will likely contribute to species maintenance in the future.

In general, the further a habitat is departed from desired conditions (natural range of variation), the greater the risk to persistence of associated species. Conversely, the closer a habitat is to desired conditions, the lower the risk to persistence of associated species. Therefore, comparing the degree to which the alternatives trend toward desired conditions provides a comparison of each alternative's effectiveness at providing habitats that contribute to maintaining species persistence.

This analysis is based on the assumption that the plan alternatives will be implemented as described and objectives will be realized over the life of the plan. Evaluation over extended spatial and temporal scales (more than 15 years) will have more inherent uncertainty than evaluation across shorter temporal and spatial scales (for example, less than 15 years).

For most species, the only practical quantitative analysis is evaluation of habitat and other ecological conditions (extent, distribution) and in many cases, this analysis will combine qualitative and quantitative features and will consider a range of potential outcomes.

The plan area is defined as National Forest System lands covered by a plan (36 CFR 219.19). For Neotropical migratory birds, the plan cannot influence habitat on the wintering grounds; therefore, the analysis will focus on requisites for breeding rather than wintering habitat.

If ecological conditions to promote species persistence were unlikely to be achieved within the plan area, the underlying conditions were evaluated to determine whether the plan area could support a viable population and or how management could be improved to maintain viability either within the plan area or contribute to persistence throughout its range using collaborative partnerships, for example.

Environmental Consequences Common to All Alternatives

Probable management activities that could potentially affect biological communities can be grouped into three broad categories: (1) changes in the type, quantity, quality, and spatial arrangement of suitable habitat; (2) direct mortality, reduced survival, or increased susceptibility to mortality; and (3) increased disturbance.

Currently, the Cibola National Forest contains uncharacteristically dense forests with many more young trees than were present historically These stands are at high risk for stand-replacing wildfire due to the accumulated buildup of both live and dead fuels as well as increased canopy density and fuel continuity. Fire regimes are disrupted in many of the vegetation types present on the Cibola, largely a result of past fire suppression policies. In general, this has led to an overall change in seral stage proportion in many of the woody vegetation types. Many stands are now characterized by a preponderance of smaller-diameter, densely distributed trees uncharacteristic of reference conditions. Reference conditions for the Cibola are characterized by forest stands containing widely spaced medium and large-diameter trees (Reynolds et al. 2013). This change in size class distribution and density effects wildlife species in a number of ways, including decreases in potential nest sites, foraging trees, and protection from predators, but also through changes in understory composition and connectivity. Denser stands decrease shrub and forb availability for ground foraging species. In addition, years of prolonged drought, combined with overstocked and denser stands, has increased the risk of uncharacteristic high intensity wildfire that could potentially eliminate large expanses of habitat. This structural departure in vegetation contributes to the departure in fire regime condition class. In general, science has shown fires are getting more frequent, larger, and more severe across all vegetation types in the Southwest (Singleton et al. 2018, Stephens et al. 2018,). Further, recent science has shown that "megafires" (fires greater than approximately 25,000 acres) are a particular threat to species that use old-growth components which can take centuries to reestablish (Jones et al. 2016).

Fuel reduction treatments that combine fire and mechanical removal can create current conditions that are more resilient to high-intensity wildfire (Stephens et al. 2012, Kalies and Kent 2016) by reducing ladder fuels and interlocking canopy at the landscape scale. All four alternatives would use mechanical treatment and fire (managed wildlife and prescribed) to restore fire-adapted ecosystems (for example, ponderosa pine and dry mixed conifer). This would ultimately improve habitat abundance and distribution for species that depend on those vegetation types and need key structural feature such as snags, large trees, and course woody material. These fire-adapted ecosystems are all highly departed from reference conditions (See table 3, above) and are included under core theme number three—"Managing Holistically for Watershed and Ecosystem Health Current" which addressed ecological integrity. Current science demonstrates the positive benefits that forest fuel-reduction treatments can have in terms of improving resiliency in fire adapted systems of the West and Southwest (Stephens et al. 2012). The "Fire and Fuels" section notes "Beneficial effects from fire consist of the acceleration of nutrient cycling, an increase in soil fertility, and improved plant productivity. Short term effects of fire include the removal of vegetation that subsequently increases soil erosion and sedimentation".

Conditions and trends in the other vegetation types (grasslands, shrublands, woodlands) did not raise significant concerns and did not emerge as a core theme during the plan revision process; therefore, no objectives were developed for them. Cibola National Forest personnel have identified desired conditions for these other vegetation types and would implement management to make progress toward desired conditions as capacity allows. Threats to species that use those ecosystems and the plan components that would mitigate them are described in detail under all action alternatives.

The primary needs for threatened and endangered species are addressed through law, regulation, and policy (such as recovery plans and conservation agreements) which are incorporated by reference. The land management plan provides the framework for implementing the recommendations from these higher-level laws, regulations, policies, plans, and agreements for these species, with limited needed additional direction.

For listed species, like the Mexican spotted owl, and species of conservation concern that use fire-adapted systems (for example, dry mixed conifer and ponderosa pine) the primary contemporary threat is loss of habitat related to uncharacteristic stand-replacing fire (U.S. Fish and Wildlife Service 2012; Jones et al. 2016; Ganey et al. 2017). Objectives would utilize mechanical thinning and wildfire (natural and prescribed) to move those systems toward a vegetative state more complementary to those species evolutionary needs. All alternatives would move ecological conditions for species that use fired-adapted ecosystems toward the desired state but vary in magnitude, intensity, and location of treatments (see below; table 91, table 92, figure 16, and figure 17). These effects are described in detail under the individual analyses that follow for each alternative. For Mexican spotted owl and its critical habitat, there could be some localized short-term adverse impacts, but overall, species viability would be maintained. All alternatives are intended to ensure that key habitat characteristics like interlocking canopy and old growth characteristics including large trees are retained and that disturbance is minimized near breeding sites. Beneficial impacts include a slight improvement in potentially suitable habitat in dry mixed conifer and ponderosa pine systems by increasing the amount of habitat in the desired seral states for breeding and foraging. Overall, actions implemented under all the alternatives are expected to retain the range of tree species (conifers and hardwoods associated with Mexican spotted owl habitat) and would not reduce the range of tree sizes needed to create the diverse forest and multi-layered forest canopy preferred by Mexican spotted owls. Some loss of trees, of all types and diameter at breast height size classes, could occur from actions such as hazard tree removal, prescribed fire, and forest thinning (as implemented under the fire management and forest health programs).

Table 91. Estimated change in optimal habitat for federally listed and regionally sensitive wildlife species that use Ponderosa Pine Forest and Dry Mixed Conifer by alternative

Species	Current potential acreage	Alt A	Alt B	Alt C	Alt D
Mexican spotted owl	50,519	113,310	111,654	111,661	111,701
Northern goshawk, Grace's warbler, red- faced warbler, Lewis's woodpecker	60,591	145,956	146,125	153,714	146,282
Bald eagle, Arizona myotis	173,088	213,984	291,977	208,745	210,977
Allen's lappet browed bat	223,718	286,988	283,698	282,331	283,619

Reflects nest and roost habitat only for spotted owl and nest and roost and fledging habitat for goshawk.

Table 92. Estimated change in optimal habitat for at-risk species that use Ponderosa Pine Forest and Dry Mixed Conifer by alternative.

Species	Current potential acreage	Alt A	Alt B	Alt C	Alt D
Mexican spotted owl	50,519	113,310	111,654	111,661	111,701
Northern goshawk, Grace's warbler, red-faced warbler, Lewis's woodpecker	60,591	145,956	146,125	153,714	146,282
Arizona myotis	173,088	213,984	291,977	208,745	210,977

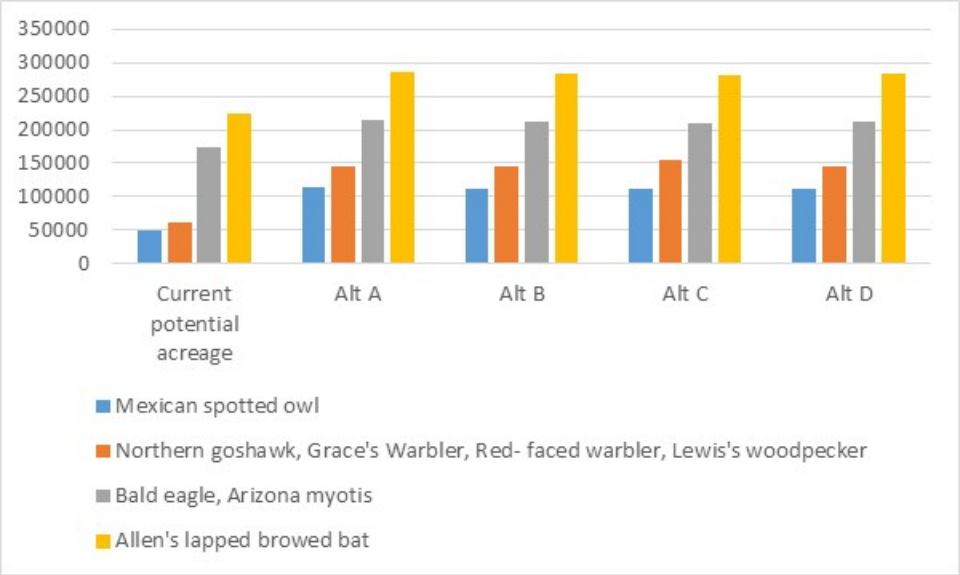


Figure 16. Estimated change in optimal habitat for federally listed and regionally sensitive wildlife species that use Ponderosa Pine Forest and Dry Mixed Conifer by alternative

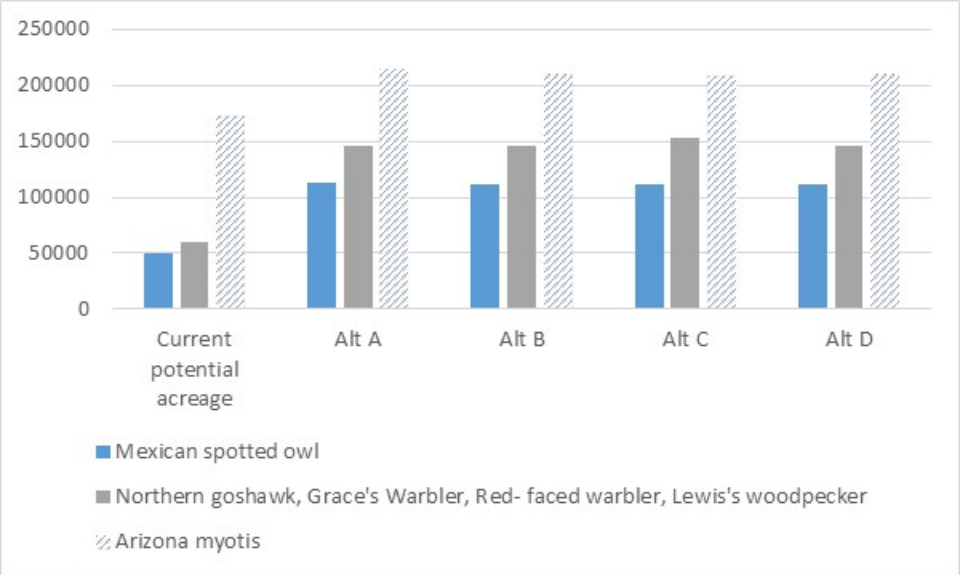


Figure 17. Estimated change in optimal habitat for at-risk species that use Ponderosa Pine Forest and Dry Mixed Conifer by alternative

The Chiricahua leopard frog, Alamosa springsnail, yellow-billed cuckoo and southwestern willow flycatcher (all threatened or endangered) do not currently occur on the Cibola. However, they occur, or have critical habitat that occurs, within an area that could be affected by management activities on the Cibola—these indirect effects would occur off the national forest. The biggest threats to these species is lack of natural flooding, and large uncharacteristic wildfire on portions of the Cibola National Forest and associated runoff from ash and sedimentation that could affect riparian habitat along the Rio Grande watershed. Generally, however, the overall intent of all alternatives is to protect these resources while maintaining multiple-use activities.

Under all alternatives, vegetation management would utilize mechanical treatment and wildland fire to move forested ecosystems to a more desired state, reducing the risk from uncharacteristic fires on downstream habitat. Further, watershed improvement projects would have beneficial effects that restore the hydrologic attributes and natural flood regime of water resources. These projects could include stream stabilization, riparian plantings, spring restoration, ecologically friendly water developments, and road decommissioning. Improved water quality and flows are some of the effects expected from these activities that would have positive impacts on species that use riparian and aquatic systems.

For the Chiricahua leopard frog, Recovery Unit 8 includes a small part of the San Mateo Mountains (Magdalena Ranger District), and one critical habitat unit is located on private land just off the Cibola National Forest boundary in the Alamosa Warm Springs (approximately 0.6 miles away). Seeps and springs which these species both need to complete their life cycle are groundwater-dependent ecosystems. Increased frequency and extent of high-severity wildfires and resulting sedimentation could indirectly affect both species by limiting groundwater flow. Recreational use and road activity can also affect sedimentation. Roads concentrate runoff, cause persistent sediment and stability issues at stream crossings, and result in loss of vegetation along their rights-of-way. These effects result in reduced proper functioning condition, as well as water quality impacts and habitat loss. Road decommissioning which would occur to varying degrees under all alternatives would help reverse these effects. Increased temperatures and drought-related drying affects related to climate change would add additional pressure to these systems. Due to the proximity of Recovery Unit 8 to the Cibola National Forest, there is the potential for some short-term adverse effects to the frog and the Alamosa springsnail, as well as critical habitat for the frog. Although all alternatives are designed to conserve critical habitat, some restoration actions (for example, vegetation management, fuels reduction) may have short-term effects to critical habitat.

Because habitat for riparian species occurs primarily off the national forest, it is also affected by off-forest water diversions and human consumption. As a result, it will be hard for the Cibola National Forest to fully realize desired conditions for these species in the plan area. Cibola personnel will manage what they can in terms of riparian and watershed health within its capacity, but it may not be able to move these systems toward their natural state because of other activities and uses that occur outside the management authority of the Forest Service. On the Cibola, Forest Service groundwater policy (Forest Service Manuals 2560 2880) and agency technical guides provide direction for well drilling and pumping and specify these activities must not adversely affect connected riparian habitat and water quantity and quality. Special use authorities can be used to locate wells away from areas where groundwater withdrawals could have an impact; for example, riparian areas, springs, and stream channels. Because direction in the Forest Service manual is considered adequate and groundwater withdrawal is governed by State regulations, additional management direction was not specified by any of the action alternatives, and they are not analyzed in this draft environmental impact statement.

For the yellow-billed cuckoo and southwestern willow flycatcher, indirect effects from management actions, such as vegetation management, fuel reductions, and unmanaged livestock grazing, would likely not be measureable or distinguishable from other off-forest activities because downstream critical and proposed critical habitat is over 2 miles away from the national forest boundary and slope is relatively minimal. According to the soils analysis (see “Soils” section), most of the land adjacent to the Cibola is relatively lower in elevation (downhill), and effects are expected be minimal under all alternatives. For both species, activities that negatively affect the magnitude, frequency, duration, timing, and rate of change for river discharge or hydrological flow are risk factors (Graf et al. 2002).

There is potential of some sediment movement from Cibola management activities, but the use of best management practices on a project-by-project basis and the desired conditions in soil, watershed, and riparian program areas would prevent large-scale movement of sediment. As project-level work improves soil condition on the Cibola, other watershed-related benefits (reduced runoff, raised water tables, reduced stream sedimentation, etc.) may be realized in areas adjacent to, and downhill of, the Cibola. Indirect effects would be indistinguishable from effects by other management actions occurring off the Cibola. None of the alternatives would adversely affect the species or their critical habitat.

The Mexican gray wolf and northern Aplomado falcon are federally endangered experimental populations and do not have designated critical habitat on the Cibola. Both species use the Cibola National Forest for movement and foraging but are not known to breed or den there (see map packet for Mexican wolf experimental population area and recent occurrences). By definition, a nonessential experimental population is not essential to the continued existence of the species. While the 10(j) rule provides considerable discretion and management flexibility to address potential conflicts with existing human land uses and activities (for example, hunting, rangeland management) in the reintroduction area, that discretion must not preclude recovery of the species. The Cibola would continue to maintain foraging and dispersal habitat for both species under the alternatives and would not jeopardize their continued existence.

All alternatives would include wilderness and inventoried roadless areas. However, only the action alternatives would propose new wilderness. Designated wilderness and inventoried roadless areas provide positive effects for habitat connectivity by limiting barriers that reduce connectivity (for example, roads, instream structures) and minimizing disturbance to federally listed species through primitive management or lack of road construction. The Cibola manages 13 inventoried roadless areas totaling 239,143 acres. Five occur on the Mount Taylor District and 8 are on the Magdalena Ranger District. Inventoried roadless areas function as biological strongholds for populations of threatened and endangered species. They provide large, relatively undisturbed landscapes with high scenic quality that are important to biological diversity and the ecological conditions that contribute to long-term survival of many at-risk species. All alternatives would maintain lands suitable for timber production, although there would be some slight variation between alternatives as to how much land is or isn't suitable based on consistency with desired conditions and objectives. Lands not suitable for timber based on legal or technical reasons (for example, Mexican spotted owl protected activity centers, greater than forty percent slope, designated wilderness) would be the same across all alternatives. See appendix B in volume 2 for a detailed explanation of timber suitability classification across all alternatives.

Cibola National Forest personnel wrote a Zuni Mountain sucker habitat management plan (USDA Forest Service 1979b) and there was direction in the 1985 plan to use this document. Since then, New Mexico Game and Fish personnel have written a state-level Zuni bluehead sucker recovery plan (Carmen 2007). Cibola personnel will follow the State recovery plan and work with New Mexico Game and Fish personnel to reduce effects to Zuni bluehead sucker during project-level work (see Guideline FW-GDL-ARS).

Zuni fleabane is listed as threatened and is the only federally listed plant species. Critical habitat has not been designated for this species. Historically the primary threat has been associated with mineral extraction. Roth and Sivinski (EMNRD-Forestry Division 2017) noted a general decline in population size and amount of occupied habitat that they attributed to recent droughts. They state, "In fact, the current status of the species indicates that drought may be the largest threat to the species rangewide in New Mexico." They noted only a few cattle trails within suitable habitat at the Datil/Sawtooth meta-population, and that elk was the most prevalent large herbivore using the suitable habitat. Grazing was not detected by either elk or cattle during the 2014 census. They noted fencing around the Six Mile Canyon patch in the Zuni metapopulation was still functional and excluding livestock and off-road vehicles.

Suitable habitat is relatively free on invasive species with the exception of a portion of habitat that runs along New Mexico State Route 400. Roth and Sivinski (EMNRD-Forestry Division 2017) determined that future maintenance that might impact the cut slopes on the east side of the highway or the application of herbicides within 50 feet of the pavement can potentially harm or eliminate approximately 20 percent of the type locality plants. Although not prevalent, there is concern of increased recreational impacts to Zuni fleabane, Cibola National Forest travel management planning will continue to reduce this impact. Soil condition currently is considered high risk. Soil standards and guideline may reduce impacts to Zuni fleabane under all alternatives.

Climate Change

Climate change presents an aspect of uncertainty in future conditions, disturbance regimes, and vegetative and wildlife responses. Strategies that can be used to help reduce impacts from climate change include; managing for diverse conditions, maintain healthy and connected populations, reduce the risk of uncharacteristic fire, prevent and control invasive species, and ensure ecosystem processes and habitat connectivity (The Heinz Center 2008). While how well each of the alternatives addresses these strategies varies, it is assumed that to a certain extent, climate change and associated effects to wildlife would occur under all alternatives. The "Climate Vulnerability Assessment for the Cibola NF" (Triepke et al. 2014) provides additional information on the vulnerability of the different vegetation types and habitat types to climate change.

Other Considerations

For some species where disease is a primary risk factor, it will be hard for Cibola personnel to fully mitigate risk beyond the Cibola National Forest boundaries. This includes bat species (pale Townsend's big-eared bat, Allen's lappet browed bat, spotted bat, and Arizona myotis), Rocky Mountain bighorn sheep, Chiricahua and northern leopard frog, and Gunnison's prairie dog. For these species, it will be difficult to prevent intermingling with diseased animals that may come and go from the Cibola. Effects of all alternatives for these species will be similar as they relate to managing for the outbreak or continuation of disease contact or spread. Management approaches which include partnership work with other agencies and private landowners as well as best management practices will help mitigate the spread of disease for these species. For example, contact with disease or spread from infected domestic animals such as goats or sheep may occur off or on the Cibola National Forest and goats have strayed onto the Cibola in the past (Sandia Ranger District). However, the Cibola National Forest personnel are not responsible for managing the spread of the disease outside the national forest boundary. Cibola personnel limit this threat by restricting goat and sheep use in areas which overlap with bighorn sheep habitat in the Manzano Mountains Wilderness and Mountainair Ranger District where bighorn sheep currently occur.

Spatial and temporal separation is accomplished through the permitting process and balancing multiple-use demands. Best management practices to maintain separation are applied to the extent they are effective in supporting viable populations of bighorn sheep and a healthy domestic sheep industry, as well as traditional cultural use. There are currently no areas of overlap between occupied habitat and domestic sheep grazing allotments on the Cibola (see map packet). Although disease may continue to be a latent threat, at this time, there is no evidence of a decline in the Rocky Mountain bighorn sheep population on the Cibola National Forest.

Under all alternatives, for all other vegetation types except Ponderosa Pine Forest and Dry Mixed Conifer, future management will be similar to current management, and consequently, environmental consequences are expected to be similar under all plan alternatives. All vegetation types are expected to remain either moderately or highly departed (at risk) except for Mountain Mahogany/Mixed Shrubland, Montane/Subalpine Grassland, and Semi-Desert Grassland which are in low departure (not at risk); and only PJ Woodland (currently moderately departed and at risk) is projected to be in low departure (not at risk) in the near and distant future. These same conditions and trends also apply to vegetation-related characteristics such as fire regime, patch size, species composition, ground cover, soil condition, etc., as these characteristics are intricately associated with, and dependent upon, vegetation structure.

The amount of shrublands, grasslands, pinyon juniper types, and abiotic features (including caves and mines, rocky outcrops, cliffs, canyon habitat, and soils) are not expected to change under any alternative. Pinyon juniper woodlands, grassland/shrubland systems all have moderate to low departures from desired conditions, so there are no treatment objectives for these vegetation types (See “Vegetation” section). It is expected that given current rates of treatment, pinyon juniper woodlands would improve to a low departure category (55 to 30 percent). Otherwise habitat condition would remain the same. For the bat species, Rocky Mountain bighorn sheep, American peregrine falcon, and Gunnison’s prairie dog that depend on these vegetation and habitat types, viability would be maintained through plan components that minimize risk for disturbance and disease spread. Active management activities could affect individual animals, but would not lead toward federal listing or loss of viability.

For all alternatives, future management is concentrated in the Ponderosa Pine Forest and Dry Mixed Conifer vegetation types which are the predominate vegetation types on the Cibola and the most highly departed from reference conditions. Management intensity in these two vegetation types varies by alternative but overall all alternatives move the Cibola toward the desired state.

All alternatives would retain designated wilderness areas - Management Area 1 (Sandia Mountain Wilderness), Management Area 3 (Manzano Mountain Wilderness, Apache Kid Wilderness, and Withington Wilderness), and special use designated area Management Area 7 (Langmuir Research Site) which contains designated critical habitat for Mexican spotted owl.

Environmental Consequences – Alternative A

Summary

The 1985 plan, as amended, does not allow the use of managed wildfire outside wilderness areas and does not address prescribed fire use in most of the mixed-conifer types (frequent fire and mesic) to maintain or improve stand structure, maintain or decrease fuel loads, or to achieve other resource benefits. With the existing level of managed wildfire and a lack of restoration emphasis concerning prescribed fire in mixed conifer, the risk of losing fire adapted vegetation types to stand-replacing wildfire, and the resulting uncharacteristic open state, increases over time.

The potential loss of habitat components due to large, high-severity wildfires could have particularly negative effects on species like Mexican spotted owl, northern goshawk, Lewis's woodpecker, red faced warbler, Grace's warbler, Allen's lappet browed bat, and Arizona myotis. Mixed conifer and pine habitat is highly departed from reference conditions and trending away; this trend would continue (see "Affected Environment" section above and "Vegetation" section of this document). Alternative A would continue to maintain the current rate of mechanical treatment (2,000 to 5,000 acres annually, the same rate as alternatives B and D) and would implement less prescribed fire (3,500 to 10,000 annually) and managed wildfire (2,000 to 5,000 acres annually) than the other alternatives. This would move those vegetation states toward desired conditions at a slower rate than alternatives B, C, and D for the majority of species that depend on fire adapted ecosystems. Of the four alternatives, understory structure would likely improve the least overall under alternative A, based on the projected levels of mechanical treatment and fire. Mechanical treatments, prescribed fire, and managed wildfire in Ponderosa Pine Forest and Dry Mixed Conifer vegetation types strive to create stand structure and landscape patterns that approach historical conditions and improve fire regime. This is expected to occur under all alternatives, but least under alternative A because it contains the smallest amount of mechanical treatment, prescribed fire, and wildfire among the alternatives.

Under 15 years, desired conditions for mixed conifer would remain moderately departed but would move closer to the desired state. Departure would decrease from 58 to 52 percent. Ponderosa pine would remain highly departed (70 percent) but slightly improvement from current conditions (77 percent departure). This would be a slight overall improvement from current conditions but the least progress toward desired conditions out of all the alternatives.

The Cibola National Forest currently has 137,712 acres designated as wilderness. In addition to these acres, it has 246,000 acres classified as inventoried roadless areas. Current wilderness designations would be maintained, but no new wilderness would be recommended under alternative A, nor would any wild and scenic rivers be proposed for designation. Alternative A also has the most acres designated as suitable timberland at 88,403 acres.

Most of the standards and guidelines that have the potential to benefit wildlife in the 1985 plan are also found in the action alternatives in the form of desired conditions, guidelines, or management approaches. In many places, the 1985 plan reiterates existing law, regulation, or policy, but these are incorporated by reference in the action alternatives and are considered more specifically at the project level.

The 1985 plan lacks a description of desired conditions for many of the key ecological characteristics for at-risk species, making it harder to ensure projects are implemented in a consistent manner, and that projects are moving toward a common set of desired conditions and long term goals. Detailed desired condition descriptions are provided for ponderosa pine, mixed conifer, and spruce vegetation types as a result of the 1996 plan amendment. The standards and guidelines adopted under the 1996 plan amendment provided a level of protection and restoration of Mexican spotted owl and northern goshawk habitats. However, some components restrict restoration opportunities in mixed conifer and pine-oak vegetation types; for example, allowing only removal of trees 9 inches in diameter or less in spotted owl protected habitat. Alternative A does not contain guidelines that would retain species-specific (fine-filter) wildlife habitat components such as guidance for rare endemic species, protections for cave dwelling mammals like bats, and measures that prevent the spread of certain invasive species including wildlife diseases (for example, white nose syndrome, chytrid fungus). The 1985 plan is also missing direction that influences animal movement and promotes connectivity of wide-ranging species, such as wildlife-friendly fence improvements; it also fails to consider patch dynamics and habitat fragmentation.

Prescriptive (restrictive) standards and guidelines in the 1985 plan make it difficult to apply adaptive management as our understanding about management effects on ecosystems and wildlife changes. Adaptive management will be essential to effectively manage for climate change and invasive species in changing and uncertain conditions. Current direction for invasive species is primarily focused on noxious weeds. Climate change has the potential to affect all wildlife species and influences the likelihood of large-scale disturbance (for example, fire, bark beetle outbreaks) across the landscape. Alternative A does not recognize climate change and offers limited guidance associated with management activities (for example, salvage logging, blow down) related to such disturbance events. Guidance for salvage operations is general in nature and focuses more on the enhancement of timber production rather than an integrated approach that balances management with other resource values such as wildlife habitat. Cibola personnel would continue to follow existing law, regulation, policy and best management practices to address species viability concerns in areas affected by large-scale disturbance.

The 1985 plan was developed before the Cibola National Grasslands was administratively separated and includes language that is no longer relevant to species in the mountain districts. It is organized by management area with no recognition of landscape pattern and connectivity and limited recognition of the role scale plays in wildlife habitat selection (Wiens 1989). On the Cibola, this is especially apparent for species that use forested and riparian habitat and have different needs at the breeding or nest site versus dispersal versus foraging areas. Finally, advances in current science have demonstrated the important role composition and structure play in southwestern frequent-fire forests and the important ecological role of wildland fire since the 1985 plan was written (Reynolds et al. 2013, Miller and Aplet 2016).

In summary, alternative A has general direction to protect the diversity of plant communities and seral stages; however, plan direction is based on outputs rather than outcomes and fails to address current scientific thinking on the use of wildland fire and vegetation management as a way to promote ecological integrity, resilience, and wildlife diversity. Projects and activities would be guided by agency direction for managing candidate species and direction to manage regional forester's sensitive species. For sensitive species, project proposals would be evaluated at the project level to ensure they do not lead to a trend towards federal listing. Viability would be maintained for all species and there would be no trend toward Federal listing for sensitive species; however, this alternative would make the slowest overall progress for the most species in terms of wildlife habitat improvement out of all the alternatives.

Alternative A fails to address or poorly addresses the following:

- the lack of emphasis on restoration increases the risk of negative effect on ecological resilience in a timely manner (issue 3)
- climate change, connectivity, and noxious invasive weeds are not explicitly recognized or incorporated (issue 3)
- there is no clear direction for watershed improvement or overall riparian health
- monitoring plan lacks integration across resource areas and was not designed with the concept of adaptive management nor does it consider key ecological conditions for species of conservation concern
- not based on current and emerging best available scientific information due to age of the 1985 plan
- not developed using complementary ecosystem and species-specific approach for at-risk species

Federally Listed Species

The current land management plan has numerous standards and guidelines that require the evaluation and protection of federally listed and regionally sensitive species. These were recently evaluated in the "Biological Assessment for the Continued Implementation of the Land and Resource Management Plans for the Eleven National Forests and National Grasslands of the Southwestern Region" (USDA Forest Service 2011g) and the resulting 2012 programmatic biological opinion (U.S. Fish and Wildlife Service 2012c); collectively referred to as the biological assessment-biological opinion 2012.

Refer to table 91 and figure 16 in the preceding section for comparisons of alternatives for fire-adapted ecosystems.

Mexican Spotted Owl

Mexican spotted owl and its designated critical habitat is protected by the standards and guidelines that were included in the 1996 plan amendment to the 1985 plan. Projects and program activities implemented under the 1985 plan may occur near or within Mexican spotted owl protected activity centers and within critical habitat. Direction for the owl and its habitat in the existing plan directly incorporates guidance from the 1995 recovery plan. This guidance's is no longer current and at times is in conflict with newer direction and or direction for other species such as northern goshawk. Mexican spotted owl guidance would take precedence over other species in protected and restricted areas and recommendations outlined in the revised recovery plan (U.S. Fish and Wildlife Service 2012b) would be followed. While the standards and guidelines provide protection for the owl and maintain their viability on the forest, some elements preclude restoration opportunities to increase habitat resilience under this alternative. The revised recovery plan recognizes uncharacteristic wildland fire as the greatest risk to the species' persistence and encourages the use of fire and vegetation management as a restoration approach, this thinking has changed since the recovery plan was originally written. Since the owl was listed in 1993, the key threat has shifted from even-aged timber management to stand-replacing fire (U.S. Fish and Wildlife Service 2012). Some additional threats and factors influencing the Mexican spotted owl include fuels reduction activities, fuelwood collection, recreation, ungulate grazing, roads and trails, and land development. See the recovery plan for detailed information on current threats.

Cibola personnel would continue to incorporate appropriated conservation actions. See the Endangered Species Act section 7(a)(1) discussion above in the "Effects Similar for All Alternatives" section for actions Cibola National Forest personnel continue to take to mitigate risk to the owl.

According to the biological assessment-biological opinion 2012, the overall assessment of the Cibola land management plan was positive for Mexican spotted owl. Analyses of the standards and guidelines concluded that programs within the Cibola would not appreciably impact the primary constituent elements to the point that critical habitat for the owl is no longer functional. The assessment also found forest management actions should increase the sustainability and resiliency of Mexican spotted owl habitat (particularly through fuels management and forest restoration actions) and that continued implementation of the Cibola land management plan is not expected to further diminish the conservation contribution of critical habitat to the recovery of the Mexican spotted owl. The biological opinion concluded that continued implementation of the land management plan was not likely jeopardize the continued existence of the Mexican spotted owl and is not likely to destroy or adversely modify designated critical habitat. Standards and guidelines for alternative A have not changed since the biological assessment-biological opinion 2012 and can largely be found under management prescriptions applicable to all areas for old growth and Mexican spotted owl (1996 amendment number 7). Many of the standards and guidelines are redundant with the old (1995) recovery plan for the owl.

Under the 1985 plan, habitat for the owl is highly departed, but trending upward in suitability. For the owl, based on VDDT[51] modeling, it is estimated the amount of dry mixed conifer available for nesting and roosting would increase in 15 years from 10 to 23 percent (15,308 acres to 36,227) and ponderosa pine/Gambel oak stands would increase from 8 to 17 percent of the Cibola (35,211 to 77,083 acres). Overall, nest and roost habitat would increase from 50,519 acres to 113,310 acres. According to the VDDT model results, alternative A has the potential to move more forest into the desired state for nest or roost habitat than the other alternatives; however, this number likely over represents the amount of habitat suitable for the owl.[52] Alternative A also has the most amount of forest classified as suitable timber (see volume 2, appendix B) and the least amount of designated wilderness.

Table 93. Current and projected Mexican spotted owl suitable availability under alternative A

Vegetation Type	Current nest/roost	Nest/roost in 15 Years	Percent Change
PPO	35,211	77,083	+9
DMC	15,308	36,227	+13
TOTAL	50,519	113,310	+22

PPO = ponderosa pine/Gambel oak, DMC = dry mixed conifer

Determination: There could be some short-term localized adverse impacts to the owl and its critical habitat, but overall, species viability would be maintained. Beneficial impacts include an increase in nesting and roosting habitat.

Mexican Gray Wolf

Large area size, adequate prey, and security from human exploitation as the three basic ecological needs of the Mexican wolf (U.S. Fish and Wildlife Service 2010). Where Mexican wolves have been reintroduced in Arizona and New Mexico, prey does not appear to be limiting (U.S. Fish and Wildlife Service 2010). Reintroduced wolves show a strong preference for elk (U.S. Fish and Wildlife Service 2015) and the implementation of the plan can influence ungulate prey populations both positively and negatively through impacts to habitat. Implementation of all alternatives is expected to maintain prey population habitat and elk in particular is an abundant prey item in the Cibola National Forest (USDA Forest Service 2014b). However, overall forage availability would decrease over time due to increases in tree and shrub density given current rates of vegetation treatment. This could lead to decreases in prey base for the wolf. Decommissioning of roads (0 to 1 miles annually) would help mitigate human interactions and vehicle collisions over the life of the plan, but this is less than under any other alternative. There would be no new wilderness added under this alternative.

[51] Vegetation states that provide optimal habitat for some species were defined when possible. Not all species use all vegetation states. Habitat is associated with vegetation types potentially used by each species and the vegetation states that they would benefit from the most.

[52] It is important to note that VDDT modeling is not spatially explicit and model outcomes for each alternative do not account for specific location(s) of where any management action will (for example, wildland-urban interface, restoration management area) or will not (recommended wilderness, conservation area, place-based management area) occur; only the alternative-specific forestwide acreages of proposed activity are taken into account. However, because alternative-specific plan components guide where vegetation management activity is most likely to occur (restoration management areas, wildland-urban interface) and least likely to occur (wilderness areas, conservation areas, site-specific management areas, etc.), effects of vegetation management are expected to be concentrated in wildland-urban interface and restoration management areas. Conversely, effects of lack of vegetation management are expected to be concentrated in wilderness areas, conservation areas, and place-based management areas.

Determination: While some individuals could be impacted by actions on the Cibola, the alternative management activities would not adversely affect the viability of the species. Overall, species viability would be maintained. Beneficial impacts include a slight improvement in connectivity and reduction of collisions by decreasing the amount of roads.

Aplomado Falcon

The northern Aplomado falcon does not currently occur on lands administered by the Cibola, based on lack of observations during breeding bird surveys and nest surveys. Although the Aplomado falcon does not currently use the Cibola National Forest for nesting, a limited amount of Chihuahuan desert scrub (2 percent of the forest) and semi-desert grasslands may provide foraging habitat (7 percent of the Cibola). Semi-desert grasslands was found to have a low departure from reference conditions and Chihuahuan desert scrub was not assessed. The 5-year review for the falcon (USDI 2014) describes highly suitable potential habitat and availability of grassland birds for prey as key limiting factors, and that an ecosystem based management approach that protects and improves existing grasslands is recommended to benefit falcons and other grassland species. Limiting disturbance and shrub encroachment and proper management of fire, invasive species, and grazing can all help improve the development of healthy native grassland communities and habitat suitability for Aplomado falcons and other birds. The main impacts that could occur from future projects are those that could reduce grassland habitat and the associated prey base.

The vegetation departure for semi-desert grassland was found to be at low-risk and within reference or desired conditions and not at risk. It is estimated the amount of semi-desert grasslands would not change under this alternative; however, it is predicted the overall condition of grasslands would remain static and then ultimately continue to decline as a result of tree and shrub encroachment and decreases in livestock distribution.

Determination: While some individuals could be impacted by actions on the Cibola, the alternative management activities would not adversely affect the viability of the species. Overall, species viability would be maintained.

Chiricahua Leopard Frog, Alamosa Springsnail, Yellow-Billed Cuckoo, Southwestern Willow Flycatcher

As mentioned above under “Actions Common to All Alternatives”, the Chiricahua leopard frog, Alamosa springsnail, yellow-billed cuckoo, and southwestern willow flycatcher do not occur on the Cibola National Forest but have habitat close to it. The 1985 plan includes several standards and guidelines that would protect this type of habitat. These include noxious weed management, riparian habitat protection, and grazing requirements. Site-specific best management practices for soils and watersheds would further reduce negative affects resulting from sedimentation and discharge. Objectives that would improve riparian and spring related habitat would be limited (0 to 1 projects annually); however, soil condition is expected to improve annually in priority watershed areas and on 8,500 acres annually (midpoint of range of objective acres) of vegetation projects (mechanical treatment plus prescribed fire) in the Ponderosa Pine Forest and Dry Mixed Conifer vegetation types. Alternative A will have the least effective outcome in terms of improving fire regime condition class, and wetland integrity. Alternative A does not address the identified needs for change for riparian areas. In addition, guidance provided in alternative A for riparian areas is not clear or adequate to protect the proper functioning condition of riparian areas including the appropriate vegetative components. Due to the lack of direction on restoration activities and watershed conditions, this alternative provides the slowest rate for achieving watershed improvement desired conditions (see “Water Resources” section).

Determination for southwestern willow-flycatcher and yellow-billed cuckoo: While some individuals could be impacted by actions on the Cibola, the alternative management activities would not adversely affect the viability of the species. Overall, species viability would be maintained. Viability for these species would be maintained, but there would be very limited change to riparian habitat quality.

Determination for Alamosa springsnail and Chiricahua leopard frog: There could be some short-term localized adverse impacts to the Alamosa springsnail and the Chiricahua leopard frog and its critical habitat, but overall, species viability would be maintained. However, there would be very limited change to riparian or spring habitat quality.

Zuni Bluehead Sucker

Under the 1985 plan, there are no clear standard and guidelines addressing the three key threats: altering hydrology, predation, and invasive species. This means these threats will continue to have effects on Zuni bluehead sucker and its critical habitat.

Determination: While some individuals could be impacted by actions on the Cibola, the alternative management activities would not adversely affect the viability of the species. Overall, species viability would be maintained. Viability for the species would be maintained, but there would be very limited change to aquatic habitat quality.

Zuni Fleabane

Because this species consists of scattered populations that overlap with uranium-rich areas, mineral exploration and development is considered the primary threat (U.S. Fish and Wildlife Service 1988). This threat is reduced under both the 1985 plan (pages 69 and 70) which provides direction to manage threatened and endangered species habitat to achieve recovery and by section 7(a)(2) requirements under the Endangered Species Act. Under the 1985 plan, soil conditions within the PJ woodland vegetation types is at high risk. There is no specific management area, guideline, or standard to bring it back to satisfactory condition.

Determination: While some individuals could be impacted by actions on the Cibola, the alternative management activities would not adversely affect the viability of the species. Overall, species viability would be maintained.

Sensitive Species

Forest Ecosystems Including Fire-Adapted Ecosystems (Ponderosa Pine Forest and Dry Mixed Conifer Vegetation Types)

Sensitive species that depend on fire-adapted ecosystems would benefit from the 1996 plan amendment which includes standards and guidelines supporting a variety of structural stages, canopy cover, and distribution of snags, large trees, and coarse woody debris across the landscape. In addition, the current rate of treatment would continue to improve optimal habitat for these species. Based on VDDT modeling, the following show the change in frequent fire habitat conditions in 15 years:

Ponderosa Pine Forest

- Goshawk habitat would increase from 8 percent to 23 percent (44,272 to 105,830 acres).
- Allen's lapped-browed bat habitat, Arizona myotis, and bald eagle habitat would increase from 38 percent to 47 percent (173,088 to 213,984acres).

Dry Mixed Conifer

- Goshawk habitat would increase from 10 to 26 percent (16,319 acres for a total of 40,126 acres).
- Allen's lapped-browed bat habitat would increase from 32 to 46 percent (50,630 to 73,004 acres).

Table 94. Current and projected fire adapted ecosystem availability under alternative A

Vegetation Type	Species	Current Acres	Acres In 15 Years	Percent Change
PPO	goshawk	44,272	105,830	+15
DMC	goshawk	16,319	40,126	+16
Total	NA	60,519	145,956	+31
PPO	Allen's lapped-browed bat habitat ,Arizona myotis, bald eagle habitat	173,088	213,984	+9
DMC	Allen's lapped-browed bat	50,630	73,004	+14

PPO = ponderosa pine/Gambel oak, DMC = dry mixed conifer

Overall goshawk habitat for nesting, roosting and fledging would increase from 60,591 to 145,956 acres. This increase in habitat is more than alternatives B and D but less than alternative C.

Habitat for the bald eagle and Arizona myotis would increase from 173,088 to 213,984 acres. Habitat for Allen's lappet eared bat would increase from 223,718 to 286,988 acres. This would result in more available habitat for these species than alternatives C and D but less habitat than alternative B.

The differences in habitat can be attributed to the different vegetative structural stages that are important for each species. See table 91 and figure 16 for a comparison of alternatives.

Determination: Based on the analysis of trend in the amount of habitat provided for each of the above species, viability would be maintained for each of these species dependent on ponderosa pine and mixed conifer habitat under the no action alternative. While individual animals could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species. Beneficial impacts would include improvements in habitat quality for foraging, breeding, and dispersal.

Riparian and Aquatic Associated Species (Includes Riparian Vegetation Types and Constructed and Natural Waters)

- Dumont's fairy shrimp
- Northern leopard frog
- Allen's lappet browed bat
- Spotted bat
- Pale Townsend's big-eared bat

Sensitive species that depend on riparian or wetland habitat and either constructed or natural waters have several standards and guidelines in the 1985 plan that protect wetland and aquatic habitat on the Cibola National Forest (page 69). These include invasive weed management, riparian habitat, and grazing requirements. These requirements would help maintain viability. For these species, the amount of habitat is not likely to change from the current condition.

There could be a slight increase in quality of habitat as projects come on line with a current objectives to improve water resource features (0 to 1 annually) and structural improvements (5 to 10 annually), but desired conditions would be achieved at a slower rate than under the other alternatives. Alternative A would have the poorest outcome for improving fire regime condition class and wetland integrity and the second poorest outcome for improving stream health and riparian habitat (see the "Water Resources" section).

Determination: Based on the analysis of plan components and the amount of habitat provided for each of the above species, viability would be maintained for each of these species dependent on riparian and aquatic habitat under the no-action alternative. While individual animals could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species. Beneficial impacts include slight improvements in riparian habitat and watershed condition class.

Nonforested Ecosystems (Grasslands, Shrubland, Pinyon Juniper Vegetation Types)

Special Habitat Features (Cliffs and Rocky features, Soils and Burrows)

- Pale Townsend's big-eared bat
- Spotted bat
- Gray vireo
- American peregrine falcon
- Burrowing owl
- Gunnison's prairie dog

The 1985 plan has limited direction related to features needed by sensitive species that depend on grasslands, meadows, shrublands, desert systems, caves and mines, rocky outcrops, or cliffs and canyons.

These species and features are indirectly affected by standards and guidelines for recreational uses, mineral development, and range management. Their main protection is the requirements to protect sensitive species which are addressed outside the plan and through site-specific best management practices. The quantity and quality of these ecosystems and associated habitat is not expected to change under the 1985 plan. For peregrine falcon, there is existing guidance to limit disturbance for essential nesting habitat and timing restrictions during the breeding season. For prairie dogs, existing plan direction limits forage improvement activities and population control projects in areas where prairie dog towns are larger than 15 acres; however, there is no mention of disease, which is the species' primary limiting factor. Burrowing owls are dependent on the presence of prairie dog colonies which area largely impacted by disease.

Poisoning, plague, and other known threats can have a significant impact to prairie dogs and their habitat. When these threats are combined, eradication of entire prairie dog populations is possible which leads to reduced or eliminated habitat required by other at-risk species. Loss of prairie dogs or lack of management for prairie dogs on private and State land necessitates large areas of Federal land to support prairie dog colonies and their associated species. The presence of plague creates inherent unpredictably in prairie dog management on the Cibola and creates a major obstacle in the conservation of prairie dogs and other at-risk species.

Gray vireo and pale Townsend's big-eared bat could be affected by fuelwood collection activities, which have the potential to reduce nesting and roosting habitat. Fuelwood collection would be managed through the permit system on the Cibola. Fuelwood permits would be maintained at the existing rate (approximately 9,000 to 12,000 cords annually) for a maximum of 180,000 cords over the life of the plan. This is the same as alternatives B and D.

Both bat species could be impacted by the presence of white-nose syndrome. The 1985 plan does not address this threat because it was only discovered in 1996. However, Cibola personnel could limit this impact through timing restrictions and installing gates on mines and caves that could be vulnerable to that theat.

Pinyon juniper woodlands, grassland/shrubland systems all have moderate to low departures from desired conditions, so there are no treatment objectives for these vegetation types (See "Vegetation" section). It is expected that given current rates of treatment, pinyon juniper woodlands would improve to a low departure category (55 to 30 percent). Otherwise habitat condition would remain the same.

Determination: Based on the analysis of plan components and the amount of habitat provided for each of the above species, viability would be maintained for each of these species dependent on grasslands, shrubland, and pinyon juniper vegetation types under the no-action alternative. While individual animals could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species.

Pinyon Juniper woodlands, Colorado Plateau/Great Basin, Mixed Conifer-Aspen and Ponderosa Pine Vegetation Types

- Villous groundcover milkvetch
- Sandia Mountain alumroot
- Zuni milkvetch
- Sivinski's fleabane

Sensitive species that depend on these ecosystems would benefit from the 1985 plan. The 1996 plan amendment includes standard and guidelines supporting a variety of structural stages, canopy cover, and coarse woody debris across the landscape. This would improve ground cover for species within the ponderosa pine vegetation types. This is also a fire-adapted ecosystem, and based on VDDT modeling, there would be an improvement on the overall habitat which would help species like the villous groundcover milkvetch. Between the alternatives, there is not much variation—only about a 1 percent change. Alternative A is higher than alternatives B and D and the same as alternative C. All four plant species are expected to be impacted under alternative A.

These species and features are indirectly affected by standards and guidelines for recreational uses, mineral development, and range management. There are standards and guideline to protect sensitive species, but the species are not specified individually. The quantity and quality of these ecosystems and associated habitat is not expected to change under the 1985 plan. Viability for these species would be maintained by requirements to protect sensitive species which are addressed outside the plan. There are no specific guidelines to address herbivory from grazing ungulates. If there are cattle within the areas, there is a chance for predation of the plants to occur, but with grazing standards and guidelines this impact should be minimal. Impacts from wildlife are also possible but are not expected to cause a decline in population numbers. Poor soil conditions can have an impact to each of these species, especially the ones that are within the PJ woodlands vegetation types. Soil conditions are at risk and can have a negative impact to plant species that rely on this soil type.

Cibola personnel follow the best management practices to help improve soil conditions. This is not addressed in the 1985 plan. Viability for these species would be maintained by using these practices. Recreation is a threat to the Sandia Mountain alumroot. Under the 1985 plan, there is a general description to protect natural resources, but it does not specify protecting plant species from recreation activities. Impacts are expected due to recreation actives, but viability is not expected to be negatively affected.

Determination: Active management activities could affect individual plants but would not lead toward Federal listing or affect viability of the populations.

At-Risk Species-Species of Conservation Concern

The 1985 plan was developed under the 1982 planning rule and does not include the species of conservation concern concept. Species of conservation concern are included as part of the current analysis and would replace regionally sensitive species if alternative A were selected. In accordance with the planning rule, each proposed species is evaluated in terms of its ability to persist in the planning unit.

The key ecological conditions for at-risk species and the key threats affecting those conditions are described under the "At-Risk Species" section for all action alternatives which follows this section. Because the 1985 plan was not explicitly developed using a complementary ecosystem and species-specific based approach (a key tenet of the species diversity requirements under the 2012 rule), alternative A would be largely limited to plan direction from the 1996 amendment and best management practices and site-specific mitigation done at the project level. If alternative A were adopted, the plan would likely need to be amended to adequately provide for viability of species of conservation concern because it lacks the ecosystem and species-level specificity required under the 2012 planning rule. The following analysis highlights the differences in plan objectives between alternative A and the action alternatives.

Forested and Fire-Adapted Ecosystems (Ponderosa Pine Forest and Dry Mixed Conifer Vegetation Types: DMC, PPF, SFF, MCW, MPO)

Mexican spotted owl, northern goshawk, red-faced warbler, Graces' warbler, Arizona myotis, American peregrine falcon, Lewis's woodpecker (* denotes federally listed species)*

- **Key ecological conditions**: Structurally diverse mature forests (seral state), conifer forest, structural heterogeneity, interlocking canopy.
- **Key threats:** Past actions, such as even-aged management and fire suppression, that have led to uncharacteristic states and highly departed conditions; risk of loss of ecological condition and habitat fragmentation of conifer forest from wildfire outside the natural range of variability; uncharacteristically high levels of natural disturbance (for example, insect outbreaks, drought); and climate change.

Species that use forested and fire-adapted ecosystems would benefit from objectives realized through the vegetation and fire and fuels management program areas. Sensitive species that depend on fire-adapted ecosystems would benefit from the 1996 plan amendment which includes standards and guidelines supporting a variety of structural stages; canopy cover; and distribution of snags, large trees, and coarse woody debris across the landscape. However, there are limitations to restoration opportunities, such as the restriction on removal of trees larger than 9 inches diameter in spotted owl protected habitat. Under alternative A, ecological conditions would improve and trend toward reference conditions.

Overall habitat for the majority of species of conservation concern that use both ponderosa pine and dry mixed conifer would increase from 60,591 acres to 145,956 acres. Overall habitat for Arizona myotis would increase from 173,088 acres to 213,984 acres (ponderosa pine only).

Under alternative A, less optimal habitat would be restored for the majority species of conservation concern that use fire adapted ecosystems than under any alternative. Arizona myotis, however, would realize slightly more optimal habitat under alternative A than under alternative C but less than alternative B. This may reflects a greater preponderance of smaller trees under this alternative since alternative A uses less mechanical treatment, prescribed fire, and wildfire than any other alternative.

Tree Features including Large Trees, Cavities, Snags, Leaves, Bark, Downed Logs, Leaf, or Forest Litter (PPF, DMC, SFF, MCW, MPO, MMS, PJG, PJO, Riparian):

Mexican spotted owl, Lewis's woodpecker, northern goshawk, red-faced warbler, Graces' warbler, juniper titmouse, gray vireo*

- **Key threats:** Loss of the large tree component and associated components is the primary threat for these species. In fire-adapted systems, large trees are rare on the landscape as a result of past management and overstocking (for example, fire suppression and even-aged management) causing a departure from reference conditions and lack of appropriate seral state. This departure from historic conditions can lead to uncharacteristic stand-replacing wildfire and wholesale loss of habitat including loss of key structural features needed for nesting, breeding, and roosting. Additional threats to tree features include fuelwood collection, uncharacteristically high levels of natural disturbance (for example, insect outbreaks, drought), and climate change. In woodland and grassland systems, fuelwood collection is the primary risk factor. In riparian systems, the primary risk factor to large trees is lack of natural flooding and groundwater levels, which limits recruitment and establishment of seedlings and radial tree growth.

Effects to at-risk species that use tree features in forested and fire adapted ecosystems would be similar to those outlined above. The 1985 plan (pages 65 and 66) provides allocation and management of at least 20 percent of each forested vegetation, thereby addressing the retention of large trees, snags, and down logs within this allocation that includes vegetation types not addressed under the 1996 plan amendment. Species that also use riparian systems (Mexican spotted owl, Lewis's woodpecker, red-faced warbler, Arizona myotis) would benefit from objectives to improve water resources at a rate of 0 to 1 projects focused in priority watersheds annually. Ecological conditions would be improved from current conditions but at the slowest rate of any alternative. Species that could be affected by fuelwood collection of large trees include juniper titmouse and gray vireo. They could be affected by objectives under the sustainable forestry and forest products program. Fuelwood would be available at the current rate—9,000 to 12,000 cords annually—the same as alternatives B and C.

Riparian or Aquatic Systems (Riparian Habitat, Seeps/Springs, Wetlands, Stock Tanks/Drinkers)

Arizona myotis, Dumont's fairy shrimp, red-faced warbler, Lewis's woodpecker, Mexican spotted owl. southwestern willow flycatcher,* western yellow-billed cuckoo,*Alamosa springsnail,* Chiricahua leopard frog,* northern leopard frog, Rocky Mountain bighorn sheep, Zuni bluehead sucker,* Rio Grande chub, and Rio Grande sucker*

- **Key ecological conditions:** riparian ecosystems (diverse herbaceous and shrub riparian composition and structure) springs, permanent and ephemeral water (natural or artificial), flowing water (ephemeral and perennial).
- **Key threats:** Loss of riparian ecological condition due to changes in natural flood regimes, water levels, or diversion; sedimentation that changes the magnitude, rate, timing, and frequency of hydrological flow from roads; activities such as grazing, vegetation, fire, and recreation management; disease; and nonnative invasive species.

Species of conservation concern that depend on riparian or wetland habitat and either constructed or natural waters have several standards and guidelines in the 1985 plan that protect and enhance wetland and aquatic habitat on the Cibola National Forest (pages 68 and 69). These include invasive weed management, riparian habitat, and grazing requirements. In addition, potential impacts from vegetation management activities are addressed by plan components that limit activities within stream courses and riparian areas (page 67-2). These requirements would help maintain viability. For these species, the amount of habitat is not likely to change from the current condition. There could be a slight increase in quality of habitat as projects come on line with a current objectives to improve water resource features (0 to 1 annually) and structural improvements (5 to 10 annually) but desired conditions would be achieved at a slower rate than the other alternatives. Alternative A would have the poorest outcome for improving fire regime condition class and wetland integrity and the second poorest outcome for improving stream health and riparian habitat (see the "Water Resources" section).

Nonforested Vegetation (PJO, JUG, MSG, CPGB, SDG, CDS, SAGE, MMS)

Aplomado falcon, Gunnison's prairie dog, burrowing owl, Rocky Mountain bighorn sheep, gray vireo, loggerhead shrike, Bendire's thrasher, juniper titmouse, *Zuni fleabane, Zuni milkvetch, and Sivinski's fleabane.*

- **Key ecological conditions:** Meadows, small openings, other grassland features, including burrows and soil, which support nesting and or burrowing; adequate forage; tall grasses for cover and foraging; diverse herbaceous and shrub composition and structure (herbaceous understory or open seral states).
- **Key threats:** Unmanaged herbivory can change local conditions and invertebrate communities by decreasing herbaceous vegetation height and structure and altering percent ground cover; shrub encroachment may decrease suitable foraging habitat or habitat for at-risk plant species; disease.

The 1985 plan has limited direction related to features needed by species of conservation concern that depend on grasslands, meadows, shrublands, desert systems, caves and mines, rocky outcrops, or cliffs and canyons.

These species and features are indirectly affected by standards and guidelines for recreational uses such as firewood gathering and recreational development (pages 61-1 to 61-2), mineral development such as mining operations (page 72), and range management utilization and vegetation manipulation standards (pages 56 through 58). Their main protection would be through site-specific best management practices. The quantity and quality of these ecosystems and associated habitat is not expected to change under the 1985 plan. For peregrine falcon, there is existing guidance to limit disturbance for essential nesting habitat and timing restrictions during the breeding season. For prairie dogs, 1985 plan direction limits forage improvement activities and population control projects in areas where prairie dog towns are larger than 15 acres. However, there is no mention of disease, which is the species' primary limiting factor. Burrowing owls are dependent on the presence of prairie dog colonies which area largely impacted by disease. Poisoning, plague, and other known threats can have a significant impact to prairie dogs and their habitat. When these threats are combined, eradication of entire prairie dog populations is possible which leads to reduced or eliminated habitat required by other at-risk species. Loss of prairie dogs or lack of management for prairie dogs on private and State land necessitates large areas of Federal land to support prairie dog colonies and their associated species. The presence of plague creates inherent unpredictably in prairie dog management on the Cibola and creates a major obstacle in the conservation of prairie dogs and other at-risk species.

Pinyon juniper woodlands, grassland/shrubland systems all have moderate to low departures from desired conditions, so there are no treatment objectives for these vegetation types (See "Vegetation" section). It is expected that given current rates of treatment, pinyon juniper woodlands would improve to a low departure category (55 to 30 percent). Otherwise habitat condition would remain the same.

Abiotic and Rocky Features:
Rocky Mountain bighorn sheep, American peregrine falcon, pale Townsend's big-eared bat, Arizona myotis, and Mexican spotted owl.

- **Key ecological conditions**: Rocky habitats which provide roosting or nest sites and adequate escape terrain
- **Key threats:** Loss or disturbance of roosting and nesting sites, disease (for example, white-nose syndrome, pneumonia)

There would be no changes in habitat quantity or quality between alternatives. Viability would be maintained through recreational uses, mineral development, and range management program areas (see "Non-Forested Vegetation" section above), but overall, there is limited plan direction to support these ecological conditions.

Environmental Consequences Common to Action Alternatives B, C, and D

Summary

The action alternatives are more strategic in nature and integrated than the 1985 plan. All action alternatives include forestwide guidance that would support species persistence and viability and would moving ecological conditions for most species toward the desired state at faster rate than under alternative A. Increased management of low-intensity wildland fire, both prescribed fire and managed wildfires, would trend a larger percentage of the area towards the historic fire regime; increase the areas resilient to disturbance, enhance and maintain stand structure; and facilitate fire suppression. Due to the proposed focus on restoration, the risk of uncharacteristic high-severity, stand-replacing crown fires would be reduced under all action alternatives. As well, reduced patch size would limit the areal extent of fires and result in less contiguous fuels in all vegetation types

All actions alternatives were developed using the ecosystem and species-specific approach to develop plan components that support at-risk species including species of conservation concern and threatened and endangered species. Substantive differences include 10 place-based management areas in alternative B and two broad-based conservation and restoration management areas in alternative C. Alternative B will not have any broad-based conservation areas or restoration management areas. Alternative C will not have any place-based management areas but will have both broad-based conservation and restoration management areas. There are no place or purposed based management areas in alternative D (table 95).

Other substantive differences between alternatives B, C, and D that could impact species viability include the amount of designated wilderness being proposed, the role of mechanical treatments and natural wildfire as a restoration tools, the amount of riparian systems restored, the amount of range improvement projects, and the amount of roads improved for ecosystem health.

Current science recognizes both wildland fire and vegetation management as tools through which ecological integrity and resilience can be managed (Reynolds et al. 2013, Miller and Applet 2016). The action alternatives more proactively incorporate this thinking. All action alternatives would provide for a substantial increase in both ignited prescribed fire and naturally ignited wildfires that can be managed for resource benefits. This would have positive effects for species that use fire-adapted ecosystems, as well as riparian associated species that can be affected by changes in hydrology and sedimentation. The action alternatives makes better use of partnerships and collaboration to maintain ecosystem integrity and resilience. This would allow Cibola personnel to get more work done on the ground than under alternative A. Current science suggests that conservation partnerships are becoming increasingly important to adaptively manage for climate change (Monahan and Theobald 2018).

Table 95. Place-based management area by alternative

Alt A	Alt B	Alt C	Alt D
No management areas	*Mount Taylor District*: Mount Taylor, Fort Wingate, Little Water Canyon, Guadalupe Management Area	No site-specific management areas	No site-specific management areas
No management areas	*Magdalena District*: Silver Hill Dark Skies, Pueblo Migrations, Enchanted Towers Management Area	No site-specific management areas	No site-specific management areas
No management areas	*Mountainair District*: Fourth of July Canyon, Jumanos Pueblos, Cement Springs, Gross Kelly Communal Grazing *Sandia District*: Las Huertas Canyon, La Madera Communal Grazing, Carnue Communal Grazing	No site-specific management areas	No site-specific management areas
No management areas	No restoration management areas, no conservation management areas	Conservation management areas (Magdalena and Mount Taylor Ranger Districts. Restoration management areas (all four districts).	No conservation management areas, no restoration management areas

Designated Areas

A comprehensive evaluation of wild and scenic rivers was conducted as part of the plan revision process which resulted in seven eligible wild and scenic rivers on the Cibola. In particular, Rinconada (Mount Taylor Ranger District) was found eligible for outstanding wildlife population and habitat remarkable values. This would have potentially beneficial impacts on wildlife species that use riparian habitat by ensuring those areas remain undeveloped and their remote character is preserved. This would minimize disturbance and promote habitat connectivity for riparian-dependent species (for example, southwestern willow flycatcher, western yellow-billed cuckoo, and Chiricahua leopard frog) and also Mexican spotted owl. The Agua Remora was also found eligible for inclusion into the wild and scenic rivers system. In all action alternatives, 1.9 miles of waterway would be included with "fish" being the outstandingly remarkable value. This would have potential benefits to the Zuni bluehead sucker.

Recommended wilderness is proposed for all action alternatives and provides positive benefits to wildlife through primitive management that minimizes disturbance and promotes habitat connectivity. This would benefit wide-ranging species like the Mexican gray wolf, Mexican spotted owl, and Rocky mountain bighorn sheep. However, the Cibola National Forest personnel would also be more limited in their ability to treat these areas and would rely on wildland fire as the main restoration tool. Limiting the ability to treat these areas may leave these areas vulnerable to large stand-replacing wildfire and cause these areas to become more departed in the future (See the "Vegetation" and "Fire and Fuels" sections). Alternative C identifies the least recommended wilderness (24,000 acres), while alternative D would include the most recommended wilderness (203,117 acres) (table 96).

Table 96. Acres of recommended wilderness by alternative

Alternative	Acres of Proposed Recommended Wilderness
Alternative A	0
Alternative B	55,533
Alternative C	24,000
Alternative D	203,117

As mentioned in alternative A above, adaptive management will be essential to effectively manage for climate change and associated impacts from disturbance events and invasive species in changing and uncertain conditions. As a result, the action alternatives include a monitoring plan designed to better inform the effects and effectiveness of management and progress towards desired conditions. Alternatives B, C, and D better recognize and address the negative effects nonnative invasive species (including disease) can have on ecosystem integrity and biological diversity. Direction for invasive species was updated and expanded to recognize the threats to ecosystem resilience from all nonnative invasive aquatic and terrestrial plants and animals likely to cause harm to ecosystems. Finally, climate change may push rare and endemic species to the limits of their range and evolutionary capacity. This is expected to be especially significant in the Southwest, an area already affected by long-term drought. The action alternatives recognize and include plan components to help address that threat and to reduce the risk of removing habitat for those types of species.

Explicit forestwide plan direction that includes beneficial language to mitigate negative impacts on wildlife from climate change, nonnative invasive species, and connectivity has been more purposefully included in the action alternatives than in alternative A (see appendices E and F for key plan components that address threats to species or species groups). These plan components would be beneficial for all wildlife species but especially those species that depend on riparian systems and fire-adapted ecosystems, endemic species, species with restricted distributions, and species that move across large landscapes and use habitat at multiple spatial scales. These plan components support resilient and resistant ecosystems that will protect species from the negative effects of climate change and will give wildlife species the best opportunity to adapt to changing conditions. This type of plan language which can be found in the action alternatives is not explicitly called out under alternative A.

The standards and guidelines are almost the same for alternatives B, C, and D, with the exception of management area plan-specific language. There is one standard proposed for the Guadalupe area to not permit livestock grazing due to accessibility issues and low production; this is the current management standard applied to the area.

Lands managed for timber and lands recommended for wilderness, changes in forage availability and livestock distribution, changes in motorized roads and watershed and structural improvements, changes in habitat restored using mechanical treatments and fire (natural and prescribed) in fire-adapted systems, along with the addition of restoration and conservation management areas are the substantive differences between alternatives B, C, and D.

In summary, the proposed actions better address and or incorporate direction for managing:

- climate change, connectivity, and nonnative invasive species;
- at-risk species and rare and endemic species;
- use of fire and vegetation management to restore wildlife habitat at multiple spatial scales;
- adaptive management and monitoring; and
- watersheds and riparian health.

Federally Listed and Sensitive Species

The action alternatives reference the most current recovery plans for listed species which will allow them to adapt to changing ideas and thinking as new science emerges and the recovery plans are updated over time. This is a key difference between alternative A, which sometimes references outdated recovery plans and scientific information. Plan components under the action alternatives which incorporate recommendations from approved recovery plans and support a more adaptive approach based on the best available science include:

Guidelines FW-GDL-ARS

1. Management activities and special uses occurring within federally listed species' habitat should integrate habitat management objectives and species protection measures from the most recent approved U.S. Fish and Wildlife Service recovery plan, to maintain the persistence or contribute to the recovery of that species. Deviation from recovery plans may occur through consultation with U.S. Fish and Wildlife Service.

6. Riparian areas should retain or improve the condition of standing dead trees, down woody material, and large mature cottonwood trees as habitat for at-risk species. Projects occurring in these areas should incorporate design features to ensure persistence and function of this habitat type and these specific habitat features.

Several plan components focus on at-risk species and or species of conservation concern but are not necessarily species specific. They do, however, add additional emphasis to key ecological conditions for many of those species. While generally broad, these plan components provide for ecosystems and habitat conditions that will be resilient to disturbance (both natural and human caused) and the interrelated effects of climate change. They also mitigate site specific effects that might occur during projects or forest management activities implemented under the land management plan in riparian areas, watersheds, terrestrial ecosystems, recreation areas, and wilderness (see volume 2, appendix E).

For federally listed and sensitive species that depend on nonforested ecosystems (for example, grasslands woodlands and shrubland) systems, like the Aplomado falcon, the action alternatives would have the same impacts. Since there are no objectives for nonforested ecosystems there would be limited change to habitat condition. For the falcon, adequate seral states that provide grasses and open conditions for hunting would be provided for through desired conditions for Semi-Desert Grasslands and Chihuahuan Desert Scrub vegetation types (FW-DC-CDS; FW-DC-SDG)**.**

Desired conditions, standards, and guidelines were added to help mitigate the potential of habitat loss or disturbance to the federally listed and sensitive species from the implementation of management activities. These plan components were developed to help ensure the ecological conditions for these species are incorporated into management activities on the Cibola. For example, plan components for sustainable rangeland and grazing would maintain habitat by ensuring multiple use activities are compatible with wildlife habitat needs (FW-DC-GR; FW-OBJ-GR; FW-STD-GR; FW-GDL-GR).

Livestock grazing guidelines help ensure grasses and forbs are available to provide habitat for grassland or understory species. This would have potential beneficial effects for wide-ranging species like the wolf and Aplomado falcon by maintaining essential foraging habitat. Beside the listed or sensitive species that are associated with these habitat types, it also provides habitat for prey species (for example, elk) for some listed or sensitive species that forage on grassland or understory species. Plan components for grazing are in addition to livestock grazing manual and handbook policy and direction. Operating instructions for livestock grazing permittees are reviewed annually and an adaptive management strategy is used to adjust use with capacity and minimize any adverse effects.

Additional plan components that would support species viability for Mexican spotted owl, Chiricahua leopard frog, Alamosa springsnail, Mexican gray wolf, Aplomado falcon, yellow-billed cuckoo, and southwestern willow flycatcher are described in detail in the "At-Risk Species" section below and under the individual analyses for each alternative.

Plan components in all of the action alternatives would improve habitat conditions and protection measures for aquatic species like the Zuni bluehead sucker, Rio Grande sucker, and Rio Grande chub. For example, action alternatives would incorporate a riparian management zone of 100 feet from the edges of all perennial streams and lakes unless site-specific conditions determine other effective widths (FW-STD-WRF). The implementation of this standard would have beneficial effects on these species.

Desired conditions and management direction for aquatic species (FW-DC-AQSP, FW-GDL-AQSP) that would be incorporated into all action alternatives would have beneficial effects on native fish species in the plan area as well as emphasize consistency with Endangered Species Act, section 7(a)(1) requirements. For example, the plan components would provide emphasis on both watershed features (floodplain connectivity and sediment transport) and site-specific habitat features (riffles, runs, pools, channel meandering). In addition, plan components (FW-DC-NIS, FW-STD-NIS) provide for prevention, early detection, and containment of aquatic invasive species. This approach is included in all action alternatives and provides a higher level of potential for watershed and habitat and species restoration in comparison to alternative A for aquatic species like the Zuni bluehead sucker, Rio Grande sucker, and the Rio Grande chub by addressing and minimized threats that include altered hydrology, predation, and invasive species.

Sensitive Species

Forested Ecosystems Including Fire-Adapted Ecosystems (Ponderosa Pine Forest and Dry Mixed Conifer Vegetation Types)

- Goshawk
- Allen's lapped-browed bat habitat
- Arizona myotis
- Bald eagle
- Villous groundcover milkvetch
- Sandia Mountain alumroot

Fire-adapted ecosystems have a high departure from reference conditions. Primary threats common to species that use fire-adapted ecosystems include the loss of mature forest components including large trees and snags, down woody debris and loss of interlocking canopy which provide nesting, roosting, and foraging habitat. These species would benefit from desired conditions, standards, and guidelines that promote the retention of these features at different spatial scales across the landscape and break of fuel continuity. Plan components for fire-adapted ecosystems would mitigate those risks.

In addition, forestwide plan components under fire, vegetation management and forestry products would help to ensure that species specific needs would be met during site specific projects. These components would help to mitigate the effects from ground-disturbing projects and provide protection from management activities that could remove key structural features such as large trees. Some species may experience short-term adverse effects from implementing these actions, but the long-term net gain would be positive by striving to create ecological integrity and restoring the natural role of fire in the system.

Riparian and Aquatic Associated Species (Includes Riparian Vegetation Types and Constructed and Natural Waters)

- Bald eagle
- Dumont's fairy shrimp
- Northern leopard frog
- Allen's lappet browed bat
- Spotted bat
- Pale Townsend's big-eared bat

- Rio Grande chub
- Rio Grande sucker

Riparian habitat, including seeps and springs, perennial streams and wetlands and other water features, occupies a very small portion of the Cibola and is highly departed. The effects of proposed management actions, including plan components and management areas, have the potential to affect riparian areas in positive and negative ways. The attributes of riparian areas that could be affected are impacts to properly functioning condition by reducing riparian vegetation, impacts to associated stream or spring features, erosion, changes in stream flows, protection from uncharacteristic wildfire, and other effects. In addition, properly functioning riparian areas have appropriate vegetative structure and composition that reflect the potential of that riparian system. Species associated with this type of habitat would benefit from plan objectives that move aquatic and riparian habitats toward the desired state (for example, proper functioning condition and appropriate vegetation and structure). The objectives and effects differ across the three action alternatives, and the total amount of habitat moved toward desired conditions over the 15-year life of the plan varies for each habitat type across alternatives. The differing amounts of habitat improved are highlighted in the individual sections for each alternative in their respective sections. Plan components that would benefit the majority of species that depend on these riparian systems and aquatic features can be found under the Nonnative Invasive Species, Terrestrial Species Habitat, At-Risk Species, Aquatic Species, Vegetation, Fire and Fuels, and Water Resources sections of the action alternatives. Additional plan components which balance multiple use with fish and wildlife needs can be found under the Sustainable Grazing and Livestock Management, Roads, and Locatable Minerals sections.

Nonforest-Dependent Species (Grasslands/Meadows/Shrubland, Pinyon Juniper Vegetation Types)

Special Habitat Features (Cliffs and Rocky features, Soils/burrows)

- Pale Townsend's big-eared bat
- Spotted bat
- Gray vireo
- American peregrine falcon
- Burrowing owl
- Gunnison's prairie dog
- Zuni milkvetch
- Sivinski's fleabane

Viability for species that utilize shrubs, grasslands, and woodland systems is largely realized through actions to meet the desired conditions for sagebrush, grassland, and pinyon juniper vegetation types, grazing management and sustainable forestry and forest products program areas. For species that utilize caves, mines, rocky features and cliff habitat, viability would also be maintained through the locatable minerals, abandoned mines lands, and recreation program areas and the caves and cliffs sections of the action alternatives.

Migratory Birds

In the action alternatives, plan components help identify and guide projects to address threats and other risks to ecological conditions important for at-risk species, including migratory birds that are species of conservation concern. Some plan components are broader and apply to all native species that occur within the plan area. In general, land management plan components and plan content were designed to meet the needs of migratory birds and other species by addressing high-priority habitats and their associated vegetation type or water or riparian habitat need where they depart from desired ecological conditions. These components include guidance on restoration approaches that reduce and limit short-term impacts while focusing on improving landscape resilience. Examples of emphasis habitats include systems that are highly altered, such as riparian habitat where hydrological flow has been reduced or eliminated by nonnative invasive species or forest activities; fire-adapted ecosystems with fire regimes outside the natural range of variability; and pinyon juniper ecosystems that have been impacted by conifer encroachment and invasive annual grasses. Many of the plan components for at-risk species (see below) would also benefit migratory birds. In particular, guidelines under infrastructure, renewable energy, and special uses would mitigate potentially negative impacts resulting from solar, wind power and transmission structures that can cause confusion and collision by birds. These include FW-GDL-RE 6-10; FW-GDL-SU 2, 8, and 10.

Common migratory birds are expected to persist on the landscape because the action alternatives strive to retain ecosystem diversity to provide for a range of habitats and provide the ecological conditions expected for the plan area to provide for ecological integrity. Although the different alternatives emphasize different approaches to moving towards desired conditions and would have different rates of movement over the life of the land management plan, they all include plan components to provide the essential elements of migratory bird habitat when later projects are proposed, and projects would continue to assess site-specific effects to migratory birds. Habitat for migratory birds is anticipated to persist under all alternatives, and there would be no long-term negative effects to migratory birds as a result of management actions implemented under the action alternatives.

At Risk Species-Species of Conservation Concern

Plan components for at-risk species were developed using the ecosystem and species-specific approach from the 2012 planning rule (See “Introduction” above), also referred to as the coarse-filter/fine-filter. This approach is critical in enabling the adaptive management feedback loop between the plan and the plan monitoring program and helps ensure that the ecological conditions for at-risk species will be maintained. All alternatives include plan direction designed to maintain the diversity of plant and animal communities and support the persistence of native species within the plan area, subject to the extent of Forest Service authority and the inherent capability of the plan area. This includes plan components that address the threats to at-risk species within the plan area. Appendices E and F provide crosswalks concerning threats identified for at-risk species and the corresponding plan components addressing those threats. The term “at-risk species” includes federally listed threatened, endangered, proposed, or candidate species under the Federal Endangered Species Act and species of conservation concern. This section also includes direction that provides for the sustainable use and enjoyment of fish, wildlife, and plants. For each species or group of species, the land management plan considers the extent that ecosystem-level plan components provide for ecosystem integrity and diversity to meet the ecological conditions necessary for those species within their range.

Species-specific plan components were added as needed. There are a number of plan components that focus on species-at risk and or species of conservation concern but are not necessarily species-specific. They do add additional emphasis to key ecological conditions for many of those species. While generally broad, these plan components provide ecosystems and habitat conditions that will be resilient to disturbance (both natural and human caused) and the interrelated effects of climate change. They also mitigate site-specific effects that might occur during projects or forest management activities implemented under the land management plan in riparian areas, watersheds, terrestrial ecosystems, recreation areas, and wilderness (see volume 2, appendix E).

At-risk species, their key ecological conditions, and threats are broadly defined below. Species have been grouped according to the ecological conditions and threats to eliminate redundancy in the analysis. Refer to the "Affected Environment" section for the vegetation types and current departure and trend that are associated with each at-risk species. The forestwide plan components described in the following section would apply to all at-risk species across all action alternatives (*indicates a listed species). Species are grouped by functional systems (for example, forested or nonforested systems with the primary vegetation types for each group of species denoted by parentheses). Appendices E and F (in volume 2) list the forestwide plan components that would apply to all at-risk wildlife species under all action alternatives.

The action alternatives have additional place-based and purpose-based plan components and different objectives which are described in their individual sections. The following analysis applies only to those plan components shared in common between the action alternatives.

Forested and Fire-Adapted Ecosystems (Ponderosa Pine Forest and Dry Mixed Conifer Vegetation Types: DMC, PPF, SFF, MCW, MPO)

Mexican spotted owl, northern goshawk, red-faced warbler, Graces' warbler, Arizona myotis, American peregrine falcon, Lewis's woodpecker*

- **Key ecological conditions**: Structurally diverse mature forests (seral state), conifer forest, structural heterogeneity, interlocking canopy.
- **Key threats:** Past actions, such as even-aged management and fire suppression, that have led to uncharacteristic states and highly departed conditions; risk of loss of ecological condition and habitat fragmentation of conifer forest from wildfire outside the natural range of variability; uncharacteristically high levels of natural disturbance (for example, insect outbreaks, drought); and climate change.

Primary threats common to species that use frequent fire forests include the loss of large trees, snags, and down woody debris and loss of interlocking canopy which provide nesting, roosting, and foraging habitat. Species that use forested systems would benefit primarily from objectives that move the Dry Mixed Conifer and Ponderosa Pine Forest vegetation types toward a more desired state and reduce risk from uncharacteristic wildfire. The objectives and effects differ across the three action alternatives and the total amount of habitat moved toward desired conditions over the 15-year life of the plan varies for each vegetation type across alternatives. The differing amounts of habitat improved are highlighted in the individual sections for each alternative in their respective sections. These systems are highly to moderately depart from desired conditions. The Spruce Fir Forest and Wet Mixed Conifer vegetation types represent a small portion of the Cibola (7 percent) and are only moderately departed from reference conditions. There are no objectives identified for these systems for the action alternatives. Desired conditions, standards, and guidelines would provide for species persistence.

Ecosystem Plan Components

Forestwide desired condition for all vegetation types (DC-VEG 1-4) support vegetation structure with a low departure from reference conditions and with a mosaic of vegetation conditions, densities, and structures at various scales across landscapes reflective of natural disturbance regimes. This would address the primary threat of uncharacteristic landscape-level wildfire for species that use fired-adapted ecosystems by restoring natural fire regimes to those systems. More specific ecosystem level plan components that would benefit the majority of species that depend on forested and fire adapted ecosystems include desired conditions to maintain appropriate seral states at the landscape (1,000 to 10,000 acres or more), mid (100 to 1,000 acres) and fine scales (less than 10 acres), while reducing fire risk through vegetation management and fuels reduction projects. Desired conditions that incorporate varying structural stages including uneven-aged forest with openings and occasional even-aged structure including large trees and snags and abundant understory (for example, coarse woody debris, logs) and old-growth components would guide the implementation of forest management activities that would move these systems toward a more favorable departure and trend from that which currently exists. The full range of life stage needs (for example, fledging, nesting, dispersal, roosting) as well as conditions that would support an adequate prey base for foraging are provided for at the landscape (FW-DC-DMC 1-3, FW-DC-PPF 1-3; Mid (FW-DC-DMC 1-5 FW-DC-PPF 1-2,4-5); and fine scales (FW-DC-DMC 1-2, 4-5; FW-DC-PPF 1-2).

Where Gambel oak and other hardwoods occur as a component in conifer forest, guidelines (FW-GDL-DMC 1) would favor their retention during project design to promote canopy cover and moister site conditions for small mammals, plants, and insects. Retention of oaks would promote biodiversity and abundant prey for foliage gleaners as well as apex predators.

Although there are no objectives identified for Spruce Fir Forest, Mixed Conifer with Aspen, and Madrean Woodland vegetation types, desired conditions would ensure appropriate structural stages, including large trees are accounted for at the landscape (FW-DC-SFF 1-3,5; FW-DC-WMC 1-5, FW-DC-MPO 1-2) mid (FW-DC-SFF 1-4; FW-DC-WMC 1-5; FW-DC-MPO 1) and fine scales (FW-DC-SFF 1; FW-DC-WMC 1; FW-DC-MPO 1).

Additional ecosystem level plan components under the fire and fuels (FW-DC-FF 1-2, 4, 7-8; FW-GDL-FF 1, 3, 5) wildland-urban interface (FW-DC-WUI 4-5) and insects and disease program areas (FW-DC-ID 1; forestwide vegetation guidelines (FW-GDL-VEG 4); and landscape scale plan components for fire-adapted systems (FW-DC-SFF 4; FW-DC-WMC 4; FW-DC-DMC-5;FW-DC-PPF 5; FW-DC-MPO 1) promote endemic levels of insect and disease disturbance, natural fire regimes and restoration activities that will allow these systems to be resilient in the face of climate change drought and other disturbance events. Plan components mitigate uncharacteristic stand replacing wildfire and outbreaks of disease and pathogens. A forestwide component specific to climate change (FW-DC-CC-1) further supports ecosystem resiliency.

Standards (FW-STD-VEG 1-4) for vegetation management would mitigate habitat disturbance and damage that might occur as a result of timber harvest, so watershed conditions are protected and the ecological needs of wildlife species are maintained. Guidelines (FW-GDL-VEG 2, 5-6; 10) would promote diversity of seral states and old-growth attributes including large trees, snags, and coarse woody material important for nesting and foraging during project implementation. Guidelines further direct that a range of restoration methods including thinning and prescribed fire are used to protect old-growth components.

The sustainable forestry and forest products program area would ensure private and commercial timber harvest is used as a restoration tool and desired conditions for that program (FW-DC-FP 1, 3-5) and would ensure these types of activities are done in a way that enhances ecological conditions for wildlife through restoration and maintenance of desired vegetation conditions. In recommended wilderness, a desired condition (FW-DC-RECW 3) and standard (FW-STD-RECW 1) support natural level of disturbance from fire, insects, and disease while FW-STD-RECW 2 prohibits timber harvest.

Species-Specific Plan Components

In addition to the ecosystem-based plan components highlighted above, a number of species-specific plan components were added to address the needs of the Mexican spotted owl and several species of conservation concern.

High-severity fires that results in the loss of dense mature forest, large snags, and downed logs effectively remove preferred nesting and roosting habitat and can take centuries to regrow. Additional fine-filter plan components (FW-DC-WMC-4, FW-DC-DMC-4, FW-DC-PPF-4) were added to ensure plan implementation meets the breeding, foraging, and roosting needs of Mexican spotted owl and northern goshawk at the mid-scale (see descriptions above—listed species this section). For the owl, standards and guidelines (FW-GDL-DMC 2; FW-GDL-PPF 2; FW-GDL-MPO 1-2) were added to reinforce consistency with the Mexican spotted owl recovery plan in Dry Mixed Conifer, Ponderosa Pine Forest, Wet Mixed Conifer, and Madrean Pinyon-Oak Woodland vegetation types. Those guidelines promote canopy cover retention to enhance the cooler, moister conditions that will provide microsite site conditions for species like the owl and its prey base, also an important consideration for climate change resiliency. Guidelines also promote retention of structures like witches' brooms for breeding, feeding, and shelter. Additional standards and guidelines added under the vegetation management and fire and fuels program areas would protect and or enhance ecological conditions for at-risk species and or critical habitat for Mexican spotted owl and include the following:

- **Standards (FW-STD-VEG 1):** Regulated timber harvest activities shall occur only on those lands classified as suitable for timber production. Management activities (timber harvest, thinning, prescribed burning.) to meet other resource objectives is permitted on lands classified as suitable or unsuitable.
- **Standards (FW-STD-VEG 2):** Timber harvest will occur only where soil, slope, and watershed conditions will not be irreversibly damaged.
- **Standards (FW-STD-VEG 4):** Timber harvest will be carried out consistent with the protection of soil, watershed, fish, wildlife, recreation, and aesthetic resources
- **Guidelines (FW-GDL-FF 6**): Ground-disturbing activities should be avoided in threatened and endangered critical habitat.

The following guidelines were added to mitigate disturbance from project management activities that might cause disturbance and nest failure during the breeding season for spotted owl, goshawk, peregrine falcon and other raptors:

- **Guidelines (FW-GDL-ARS 3):** Known active raptor nests, including those on cliff faces, should be protected from management activities and disturbance during the nesting season to maintain the persistence of or contribute to the recovery of at-risk species. Protection measures can include timing restrictions, adaptive percent utilizations, distance buffers, or other means of avoiding disturbance based on best available information and site-specific factors, such as topography, available habitat, and location.

- **Guidelines (FW-GDL-ARS 4):** Management actions that may affect nesting conditions for northern goshawks should incorporate the most current ecological guidelines to retain or improve habitat for this species. These guidelines include:
    - A minimum of three goshawk nest areas and three replacement nest areas should be located per goshawk territory. Goshawk nest and replacement nest areas should generally be located in drainages, at the base of slopes, and on northerly (northwest to northeast) aspects. Nest areas should generally be 25 to 30 acres in size.
    - Goshawk post-fledging areas of approximately 420 acres in size should be designated surrounding nest sites.
    - In goshawk foraging areas and post-fledging family areas, groups of three to five reserve trees should be retained within management created openings greater than 1 acre in ponderosa pine-evergreen oak and dry mixed-conifer communities, and six reserve trees should be retained within management created openings greater than 0.5 acre in wet mixed-conifer and spruce-fir communities.
    - Human presence should be minimized in northern goshawk nest areas during the nesting season from March 1 through September 30.

An additional species-specific plan component (FW-GDL-ARS 8) was added to identify key ecosystems characteristics associated with villous groundcover milkvetch and Sandia Mountain alumroot, and ensure site specific actions maintain suitable habitat.

- **Guidelines (FW-GDL-ARS 8):** Known populations of at-risk plant species should be protected from management activities that may degrade habitat conditions.

Tree Features including Large Trees, Cavities, Snags, Leaves, Bark, Downed Logs, Leaf or Forest Litter (PPF, DMC, SFF, MCW, MPO, PJO, Riparian)

Mexican spotted owl, Lewis's woodpecker, northern goshawk, red-faced warbler, Graces' warbler, juniper titmouse, gray vireo*

- **Key threats:** Loss of the large tree component and associated components is the primary threat for these species. In fire adapted systems, large trees are rare on the landscape as a result of past management and overstocking (for example, fire suppression and even-aged management) causing a departure from reference conditions and lack of appropriate seral state. This departure from historic conditions can lead to uncharacteristic stand-replacing wildfire and whole sale loss of habitat including loss of key structural features needed for nesting, breeding, and roosting. Additional threats to tree features include fuelwood collection, uncharacteristically high levels of natural disturbance (for example, insect outbreaks, drought), and climate change. In woodland and grassland systems, fuelwood collection is the primary risk factor. In riparian systems, the primary risk factor to large trees is lack of natural flooding and groundwater levels, which limits recruitment and establishment of seedlings and radial tree growth.

Ecosystem Plan Components

Many of the species that need diverse forest structure and old-growth components above are also dependent on large trees, snags, and other tree-related components for roosting, foraging, and nesting. Downed woody material and logs provide important habitat for small mammalian prey species. In addition to the components described above, these species would also benefit from a number of ecosystem level plan components, which would protect these key ecological conditions.

Plan components that would benefit the majority of species that depend on tree features include desired conditions to maintain appropriate levels of old trees, snags, nesting structures (for example, witches' brooms) and downed wood at multiple spatial scales. Forestwide desired conditions for the different vegetation types include the landscape (FW-DC-PPF 2,4; FW-DC-DMC 2-3; FW-DC-SFF 2-3,5; FW-DC-WMC 2-3,5; FW-DC-MPO 2; FW-DC-PJ 1), mid (FW-DC-PPF 5;FW-DC-DMC 5; FW-DC-MPO 1; FW-DC-PJ 2; FW-DC-PJ 4) and fine scales (FW-DC-DMC 1; FW-DC-PPF 1-2; FW-DC-WMC 3).

A forestwide desired condition for vegetation management (FW-DC-VEG 3) promotes the maintenance of healthy large trees for public scenery. This would also benefit wildlife species that need large trees. Forestwide components for all vegetation types include guidelines that timber harvest (including salvage) will leave adequate number of snags and coarse woody material maintain long-term soil productivity and to meet wildlife needs (FW-GDL-VEG 2).

Since fuelwood collection and snag harvest can be a risk factor for like gray vireo and juniper titmouse, two species of conservation concern, the sustainable forestry and forest products program has a desired condition that would minimize the harvest of these habitat elements (FW-DC-FP 5).

Species-Specific Plan Components

In addition to the ecosystem based components highlighted above a number of species-specific plan components were added to address the needs of the Mexican spotted owl and species of conservation concern like northern goshawk, gray vireo, and juniper titmouse that utilize tree features. These include:

- **Landscape-Scale Desired Conditions (FW-DC-SFF 6):** Dwarf mistletoe infestation size, degree of severity, and amount of mortality vary among infested stands. Witches' brooms may be scattered throughout the infestations providing structural diversity in the stand and improved habitat for wildlife species such as small mammals (for example, tree squirrels) and raptors (for example, goshawks and spotted owls).
- **Mid-Scale Desired Conditions (FW-DC-SFF 10):** Forest conditions in some areas contain at least 10 percent higher basal area than the general forest (for example, goshawk post-fledging family areas and north-facing slopes). Nest areas have forest conditions that are multi-aged but are dominated by large trees with relatively denser canopies than other areas in the spruce-fir type.
- **Landscape-Scale Desired Conditions (FW-DC-WMC 6):** Dwarf mistletoe infestation size, degree of severity, and amount of mortality vary among infested stands. Witches' brooms may be scattered throughout the infestations providing structural diversity in the stand and improved habitat for wildlife species such as small mammals (for example, tree squirrels) and raptors (for example, goshawks and spotted owls).
- **Mid-Scale Desired Conditions (FW-DC-WMC 4):** Forest conditions in some areas contain 10 to 20 percent higher basal area in mid-aged to old tree groups than in the general forest (for example, goshawk post-fledging family areas, Mexican spotted owl nesting and roosting habitats, and north-facing slopes). Interspaces with native grass, forb, and shrub vegetation typically range from 10 to 50 percent of the area. Goshawk nest areas have forest conditions that are multi-aged but are dominated by large trees with relatively denser canopies than other areas in the mixed conifer with aspen type.

- **Mid-Scale Desired Conditions (FW-DC-DMC 4):**Forest conditions in some areas contain 10 to 20 percent higher basal area in mid-aged to old tree groups than in the general forest (for example, goshawk post-fledging family areas, Mexican spotted owl nesting or roosting habitats, and north-facing slopes). Interspaces with native grass, forb, and shrub vegetation typically range from 10 to 50 percent of the area. Goshawk nest areas have forest conditions that are multi-aged but are dominated by large trees with relatively denser canopies than other areas in the Dry Mixed Conifer vegetation type.
- **Mid-Scale Desired Conditions (FW-DC-PPF 4):** Forest conditions in some areas contain 10 to 20 percent higher basal area in mid-aged to old tree groups than in the general forest (for example, goshawk post-fledging family areas, Mexican spotted owl nesting and roosting habitats, drainages, and steep north-facing slopes). Goshawk nest areas have forest conditions that are multi-aged but are dominated by large trees with relatively denser canopies than other areas in the ponderosa pine type.
- **Guideline (FW-GDL-PJO 1):** Where pinyon-juniper obligate species occur (such as the gray vireo and juniper titmouse) project design should retain an average of 6 snags (diameters greater than 8 inches at base) per acre and 1 snag (greater than 18 inches diameter at base) per acre and an average of 4 tons per acre of coarse woody material (as well as partially dead or dying trees) even when this is in conflict with other activities such as fuelwood gathering. In proposed treatment areas where there is uncharacteristically sparse understory, slash treatments (such as lop and scatter and mastication) should be used to improve herbaceous vegetation growth, soil and watershed condition, and soil productivity.

Determination: For species that use forested and fire-adapted ecosystems and that depend on large trees, the ecosystem-level plan components should provide the ecological conditions necessary to maintain viability for most species in the plan area. However, additional species-specific components have been added to maintain viability of Mexican spotted owl, northern goshawk, juniper titmouse, and gray vireo. The combination of ecosystem-level and species-specific plan components should provide the ecological conditions necessary to maintain viability in the plan area.

Riparian or Aquatic Systems (Riparian habitat, Seeps/Springs, Wetlands, Stock Tanks/Drinkers)
Arizona myotis, Dumont's fairy shrimp, red-faced warbler, Lewis's woodpecker, Mexican spotted owl. southwestern willow flycatcher,* western yellow-billed cuckoo,*Alamosa springsnail,* Chiricahua leopard frog,* northern leopard frog, Rocky mountain bighorn sheep, Zuni bluehead sucker*, Rio Grande chub, and Rio Grande sucker*

- **Key ecological conditions:** riparian ecosystems (diverse herbaceous and shrub riparian composition and structure) springs, permanent and ephemeral water (natural or artificial), flowing water (ephemeral and perennial).
- **Key threats:** Loss of riparian ecological condition due to changes in natural flood regimes, water levels, or diversion; sedimentation that changes the magnitude, rate, timing, and frequency of hydrological flow from roads; and activities such as grazing, vegetation, fire, and recreation management; disease; and nonnative invasive species.

Riparian habitat including seeps and springs, perennial streams and wetlands, and other water features occupies a very small portion of the Cibola and is highly departed. Species associated with this type of habitat would benefit from plan objectives that move aquatic and riparian habitats toward the desired state in restoration and conservation management areas. Objectives to remove, improve, or reconstruct water developments managed through the sustainable rangelands and livestock grazing program would also help to improve desired conditions for at-risk species that use stock tanks, other artificial structures, springs, and streams.

Plan components that would benefit the majority of species that depend on these vegetation types can be found under the Nonnative Invasive Species, Terrestrial Species Habitat, At-Risk Species, Aquatic Species, Vegetation, Fire and Fuels, and Waters Resources sections of the action alternatives. Additional plan components which balance multiple use with species needs can be found under Sustainable Rangelands and Livestock Grazing, Infrastructure, Special Uses, Recreation and Minerals and Geology sections of the action alternatives.

Ecosystem Plan Components

Desired conditions for watersheds (FW-DC-WTR 1-2) would move these systems toward proper functioning condition while balancing multiple use with ecological integrity. These components would help minimize sedimentation and improve hydrologic function while maintaining systems that are resilient to climate change and associated disturbances such as fire. A standard (FW-STD-WTR 1) would ensure best management practices are applied to every site-specific project that has the potential to effect the watershed conditions. Additional benefits would be realized through water resources features where desired conditions (FW-DC-WRF 1-3, 7-11) would move riparian areas to the desired state and protect them from multiples uses by ensuring that structure, function, composition, connectivity, water quality, sediment, and aquatic and terrestrial habitats are maintained or restored. FW-DC-WRF direction (4-5, 12-14) supports functional connectivity and promotes dispersal and genetic diversity. Several standards and guidelines (FW-STD-WRF 2-3; FW-GDL-WRF 1, 5, 7-10, 13-14) would mitigate adverse effects from road construction or reconstruction (which can cause sedimentation) and would rehabilitate instream structures which could improve hydrologic function and habitat connectivity and ensure barriers to movement are minimized and subsurface flows and groundwater recharge are within the natural range of variation.

Standards and guidelines for all vegetation (FW-STD-VEG 2-4) would protect the ecological integrity of watershed conditions by minimizing potentially adverse effects like ground disturbance, soil erosion, and sedimentation that can occur during timber harvest operations. Plan components for the sustainable rangelands and livestock grazing program areas (FW-DC-GR 4-6; FW-STD-GR 1; FW-GDL-GR 2-3) would ensure livestock grazing within riparian management zones is compatible with ecological function and riparian vegetation desired conditions. Guidelines (FW-GDL-GR 3-4) also prevent the construction of new structures in riparian management zones and minimize potentially adverse effects the construction of such structures may have on soil integrity and hydrologic function of natural springs sources.

Guidelines under the locatable minerals program area (FW-GDL-LOC 5- 6) would protect riparian areas from streambed and floodplain alteration and surface and groundwater contamination. Guidelines for the roads and renewable energy program areas (FW-GDL-RD 2, 3-6,9; FW-GDL-RE 2,6; FW-GDL-SU 2,10) would minimize disturbance (for example, water flow changes, sedimentation) from the construction of roads and energy corridors by including mitigations to limit disturbance in riparian zones during project-level design and preventing the development of new utility corridors in riparian management zones. Guidelines for special uses would minimize impacts to species like the northern leopard frog, Chiricahua leopard frog, and Alamosa springsnail that use groundwater-dependent ecosystems like seeps and springs and riparian management zones (FW-GDL-SU 5, 10-11).

Species-Specific Plan Components

Nonnative plant species can outcompete native species, causing reduction in suitable habitat and alterations in riparian function while nonnative invasive animals and pathogens can cause direct mortality and predation. These threats are reduced through plan components in the nonnative, invasive species and fire and fuels sections of the plan through desired conditions, standards, and guidelines that minimize impacts to wildlife and aquatic species in streams and spring areas. These would especially benefit species like Chiricahua and northern leopard frog where the primary risk factors are disease and predation by nonnative bullfrogs.

- **Desired Conditions (FW-DC-NIS 1):** Invasive species do not disrupt the structure or function of ecosystems, species life cycles, or populations, and minimize impacts to native wildlife or plant species.
- **Standard (FW-STD-NIS 1):** Forest management activities must apply best management practices and management guidance from the most current Forest Service Southwestern Region guidance for invasive species management, to minimize the introduction or spread of invasive species, including decontamination procedures on vehicles and equipment and using weed-free products.
- **Standard (FW-STD-NIS 2):** Projects, authorized activities, and special uses shall be designed (e.g., weed hay, off-highway vehicle washing, waders) to reduce the potential for introduction of new species or spread of existing invasive or undesirable aquatic or terrestrial nonnative populations.
- **Guidelines (FW-GDL-FF-4):** Measures should be taken to prevent entrapment of fish and aquatic organisms and the spread of parasites or disease (such as chytrid fungus, Didymo, and whirling disease), when drafting (withdrawing) water from streams or other waterbodies during fire management activities.
- **Guidelines (FW-GDL-FF 7**): Post-fire restoration and recovery should be provided where critical resource concerns merit rehabilitation for controlling the spread of invasive species, protecting areas of cultural concern, protecting critical or endangered species habitat, or protecting other highly valued resources such as drinking water.

Additional species-specific plan components were added to mitigate the removal of tree-related features for at-risk bird and bat species (Lewis's woodpecker, red-faced warbler, and Mexican spotted owl, Arizona myotis) during project-level activities and to ensure multiple uses (grazing, vegetation treatment and recreation) minimize habitat loss and disturbance for yellow-billed cuckoo, southwestern willow flycatcher, and Zuni bluehead sucker.

- **Guidelines (FW-GDL-ARS 6):** Riparian areas should retain or improve the condition of standing dead trees, down woody material, and large mature cottonwood trees as habitat for at-risk species. Projects occurring in these areas should incorporate design features to ensure persistence and function of this habitat type and these specific habitat features.
- **Guidelines (FW-GDL-ARS 10):** Management actions within water resource features (such as cleaning of water developments, stock tanks, etc.) that support known populations of at-risk species should consider mitigations to reduce the effects to the overall species population. Examples of these mitigations include repair and maintenance on a single feature at a time during a given year to maintain populations across water features, conducting refueling or herbicide applications to minimize contaminants within the water feature, and ensuring proper water levels or habitat is maintained or improved during activities to prevent entire population loss.
- **Guidelines (FW-GDL-AQSP 3):** Streams, streambanks, shorelines, lakes, wetlands, seeps, springs and other bodies of water should be protected from detrimental changes (as described in species-specific literature including recovery plans, listing and critical habitat designations, and conservation strategies) to protect water quality, aquatic species diversity and quantity, riparian and aquatic habitat quality, and riparian and aquatic habitat connectivity.

The following guidelines and standards would ensure livestock management is compatible with the needs of all at-risk species and that it promotes desired conditions in riparian areas and for aquatic features. These plan components mitigate loss of connectivity, hydrological function, and riparian vegetation (see threats, above).

- **Guidelines (FW-GDL-AQSP 4):** To conserve aquatic habitat connectivity, constructed features (such as exclosures, wildlife drinkers, range improvements, fences, and culverts) should be maintained to support the purpose(s) for which they were built. Constructed features should be removed when no longer needed, to restore natural hydrologic function and maintain habitat connectivity.
- **Standards (FW-STD-GR 2):** Livestock grazing within riparian management zones should be managed to sustain proper stream channel morphology, floodplain function, and riparian vegetation desired conditions.
- **Standards (FW-STD-GR 3):** New and reconstructed range improvements must be designed to prevent wildlife entrapment and provide safe egress for wildlife (for example, escape ramps in water troughs and cattle guards).
- **Management approaches** (FW-MGAP-WTR 5; FW-MGAP ARS 1-2) that support at-risk species in riparian and aquatic areas encourage collaborative work with other agencies and adjacent landowners to replace and protect key habitats for at-risk species, including updating outdated recovery plans (like for the Alamosa springsnail), and incorporating climate change considerations into project planning. These management approaches would help contribute to species viability through each species range.

Determination: For species that use riparian and aquatic habitat, the ecosystem-level plan components should provide the ecological conditions necessary to maintain viability for most species in the plan area. However, additional species-specific components have been added to maintain persistence of Arizona myotis, red-faced warbler, Lewis's woodpecker, Mexican-spotted owl, and northern leopard frog. The combination of ecosystem-level and species-specific plan components should provide the ecological conditions necessary to maintain species viability in the plan area.

For Chiricahua leopard frog, Alamosa springsnail, southwestern willow flycatcher, yellow-billed cuckoo and Zuni bluehead sucker, it is beyond the authority of the Forest Service or not within the inherent capability of the plan area to maintain or restore the ecological conditions to maintain persistence in the plan area. Nonetheless, the ecosystems level and species-specific plan components should maintain or restore ecological conditions within the plan area to contribute to maintaining persistence and viability of those species throughout their range. A management approach has been included to encourage collaborative work to achieve this goal.

Nonforested Vegetation (PJO, JUG, MSG, CPGB, SDG, CDS, SAGE, MMS)

Aplomado falcon, Gunnison's prairie dog, burrowing owl, Rocky Mountain bighorn sheep, gray vireo, loggerhead shrike, Bendire's thrasher, juniper titmouse, *Zuni fleabane, Zuni milkvetch, and Sivinski's fleabane*.

- **Key ecological conditions:** Meadows, small openings, other grassland features including burrows and soil which support nesting and or burrowing; adequate forage; tall grasses for cover and foraging; diverse herbaceous and shrub composition and structure (herbaceous understory or open seral states).
- **Key threats:** Unmanaged herbivory can change local conditions and invertebrate communities by decreasing herbaceous vegetation height and structure and altering percent ground cover; shrub encroachment may decrease suitable foraging habitat; disease.

Ecosystem Plan Components

Persistence for species that utilize shrubs, grasslands, and woodland systems is largely realized through desired conditions for Sagebrush, Grassland, and Pinyon Juniper vegetation types and through the sustainable rangelands and livestock grazing and sustainable forestry and forest products program areas.

Desired conditions for sagebrush (FW-DC-SS 3) would ensure enough shrub cover exists for sagebrush obligate species and that the appropriate seral states and fire regimes are maintained for montane/subalpine and semi-desert grasslands (FW-DC-SDG 2-3; FW-DC-MSG 2-3).

Species that use pinyon juniper, particular tree components, including large snags for roosting, nesting and foraging, would benefit from landscape-scale desired conditions that promote heterogeneity and old-growth components in pinyon juniper woodland (FW-DC-PJ 1-2).

Because fuelwood removal can deplete these features on the landscape, desired conditions under the sustainable forestry and forest products program area (FW-DC-FP 4-5) would mitigate this threat by ensuring private and commercial timber harvest enhances and supports wildlife habitat, particularly with regard to snags and dying trees. The collection of forest products (including firewood) in research natural areas is also limited. This would include the Bernalillo Research Natural Area which contains juniper grassland and semi-desert grassland ecosystems that could be used by species like Aplomado falcon, loggerhead shrike, and Bendire's thrasher.

Desired conditions (FW-DC-GR 4-5) would ensure livestock grazing is compatible with wildlife needs; that shrubs, and forbs are available for bighorn sheep; and that grasslands provide adequate cover to sustain species like prairie dog, burrowing owl, loggerhead shrike, and Bendire's thrasher. Species that use grassland and pinyon juniper habitats would also benefit from plan components under the "Soils" section. Guidelines for soils would ensure sufficient levels of woody debris are maintained during projects and would mitigate negative effects that occur from ground-disturbing activities that cause soil loss, erosion, and compaction.

Species-Specific Plan Components

Additional guidelines were added to maintain abundant levels of dead and dying trees for pinyon juniper obligates like gray vireo and juniper titmouse and to ensure protective measure are included for species of conservation concern during project design:

- **Guideline (FW-GDL-PJP 1)**: Where pinyon-juniper obligate species occur (such as the gray vireo and juniper titmouse) project design should retain an average of six snags (diameters greater than 8 inches at base) per acre and one snag (greater than 18 inches diameter at base) per acre and an average of 4 tons per acre of coarse woody material (as well as partially dead or dying trees) even when this is in conflict with other activities such as fuelwood gathering. In proposed treatment areas where there is uncharacteristically sparse understory, slash treatments (such as lop and scatter and mastication) should be used to improve herbaceous vegetation growth, soil and watershed condition, and soil productivity.
- **Guidelines (FW-GDL-ARS 8):** Site-specific information should be used to determine if management activities may potentially impact species of conservation concern. Species-specific mitigation and protective measures should be incorporated into project design to ensure persistence of species (for example, retention of both abiotic and biotic features required for essential life history characteristics, such as breeding and foraging).

The Cibola does not currently have active allotments with domestic goats and sheep overlapping with bighorn sheep habitat (see map packet) However, stray animals that may wander onto National Forest System land could still pose a threat. The biggest threat to persistence of Rocky Mountain bighorn sheep is contraction of pneumonia. The following species-specific plan component was added to minimize the spread of disease from domestic sheep and goats within FOREST SERVICE authority and to maintain adequate forage:

- **Standards (FW-STD-GR 1):** Livestock management shall be compatible with capacity and address ecological concerns (for example, forage, invasive plants, at-risk species, soils, riparian health, water quality) that are departed from desired conditions.
- **Standards (FW-STD-GR 4):** Grazing of domestic sheep or goats shall not be authorized in areas occupied by bighorn sheep to prevent the transfer of disease from domestic sheep to bighorn sheep.

Finally, although the threat from sylvatic plague in prairie dogs, pneumonia in bighorn sheep and recreational shooting of burrowing owls are largely beyond the management authority of the Cibola National Forest, the following management approaches were added under the “At-Risk Species” section to encourage collaboration and actions that help maintain rangewide species viability:

4. Restrict recreational shooting in areas that may cause harm to at-risk species (for example, burrowing owls).
5. In coordination with New Mexico Game and Fish, consider "dusting" prairie dog colonies with flea-controlling powder to reduce the spread of sylvatic plague. When possible identify and potentially avoid burrows occupied with burrowing owls prior to application.

An additional species-specific plan component (FW-GDL-ARS 8) was added to identify key ecosystems characteristics associated with Zuni fleabane, Zuni milkvetch, and Sivinski’s fleabane and ensure site-specific actions maintain known occurrences and suitable habitat.

- **Guidelines (FW-GDL-ARS 8):** Known populations of at-risk plant species should be protected from management activities that may degrade habitat conditions.

Determination: For species that use shrub/grassland/woodland systems as noted above, the ecosystem-level plan components should provide the ecological conditions necessary to maintain viability for most species in the plan area. However, additional species-specific components have been added to maintain viability of gray vireo, juniper titmouse, and bighorn sheep. The combination of ecosystem and species-specific plan components should provide the ecological conditions necessary to maintain persistence and viability of gray vireo and juniper titmouse in the plan area. For bighorn sheep, it is beyond the authority of the Forest Service or not within the inherent capability of the plan area to maintain or restore the ecological conditions to maintain persistence. Nonetheless, the plan components should maintain or restore ecological conditions within the plan area to contribute to maintaining persistence of the species within its range. Additionally species-specific components have been added to maintain persistence of Zuni fleabane, Zuni milkvetch, and Sivinski's fleabane.

Abiotic and Rocky Features

Rocky Mountain bighorn sheep, American peregrine falcon, pale Townsend's big-eared bat, Arizona myotis, and Mexican spotted owl.

- **Key ecological conditions**: Rocky habitats which provide roosting or nest sites and adequate escape terrain
- **Key threats:** Loss or disturbance of roosting and nesting sites, disease (for example, white-nose syndrome, pneumonia)

Ecosystem Plan Components

Persistence for species that utilize caves, mines, rocky features, and cliff habitat is largely realized through the locatable minerals, abandoned mines, lands, and recreation program areas and the "Caves" section of the proposed actions. Plan components (FW-DC-TRSP 9, 10, 13) would provide caves and rocky features are frees from disturbance and well distributed for species of conservation concern, as well as Mexican spotted owl. Desired conditions and guidelines for locatable minerals ensure mining activities will be compatible with ecosystem health and wildlife and plant habitat needs and that cave-dwelling species will not be disturbed (FW-DC-LOC 1; FW-GDL-LOC 4-5, 10-12) Two standards for abandoned mine lands and caves (FW-STD-AML 1; FW-STD-CAVE 1) maintain mine and cave closures will be inspected prior to closure, and that closures will designed to accommodate historically occurring wildlife. In addition, desired conditions and guidelines for caves (FW-DC-CAVE 1, 5; FW-GDL-CAVE 3) promote biologic integrity and protection from damage and alteration.

Finally, desired conditions and guidelines for terrestrial species and habitats would also protect nonvegetative habitat components from disturbance (FW-DC-TRSP 9, FW-GDL-TRSP 1-2).

Species-Specific Plan Components

Desired conditions and guidelines were specifically added for some at-risk species to mitigate disturbance from recreational rock climbing, provide protections from disturbance during the breeding season and at maternity roosts, and to minimize the spread of white-nose syndrome in bats. The following plan components would benefit bats, spotted owl, and peregrine falcon by mitigating these threats:

- **Guidelines (FW-GDL-RD 1):** Bridges and other infrastructure that serve as important habitat for at-risk wildlife species should be maintained unless demolition is necessary for safety.
- **Guidelines (FW-GDL-GREC 2):** Recreation activities (such as rock climbing, dispersed camping, and other activities) should be managed to accommodate sustainable use levels within the capacities of other resource values, including the need to protect plants, animals (such as at-risk species), and other natural and cultural resources.

- **Desired Conditions (FW-DC-CAVE 2):** Caves known to be important for at-risk species are intact or provide habitat for these species.
- **Desired Conditions (FW-DC-CAVE 3):** Significant cave aesthetic, cultural, and scientific values remain intact, and are protected from damage to provide for uses by people (traditional cultural uses), wildlife, or both.
- **Guidelines (FW-GDL-CAVE 2):** Decontamination procedures should be followed to prevent the introduction of white-nose syndrome or other pathogens when entering caves.
- **Guidelines (FW-GDL-CAVE 4):** Where mine closure is necessary to protect human health and safety, closures should preserve habitats for roosting bats and avoid direct impacts to bats. If bat roost sites are present, closure structures such as wildlife-friendly bat gates that meet the most current recommendations should allow bats to continue to use the cave.
- **Guidelines (FW-GDL-CAVE 5):** Management of cave access for recreational purposes should be balanced with wildlife protection and/or cultural resources.
- **Standards (FW-STD-AML 1):** When closing underground mine features to public entry, pre-closure inspections shall be conducted to determine if cave-dependent species are present. Closures will be designed and implemented to address the needs of resident or historically occurring wildlife within the constraints of meeting public safety concerns.
- **Standards (FW-STD-AML 4):** Appropriately remediated abandoned mines are available for roosting bats, reducing the potential for displacement, abandonment of young, and possible mortality.
- **Guidelines (FW-GDL-ARS 3):** Known active raptor nests, including those on cliff faces, should be protected from management activities and disturbance during the nesting season to maintain the persistence of or contribute to the recovery of at-risk species. Protection measures can include timing restrictions, adaptive percent utilizations, distance buffers, or other means of avoiding disturbance based on best available information and site-specific factors, such as topography, available habitat, and location.
- **Guidelines (FW-GDL-ARS 5):** Measures to maintain at-risk bat habitat and reduce disturbance by human or management activities should be used where known bat use and concentrations of at-risk bat species occur (maternity colonies, hibernacula, seasonal roosts, or foraging habitats). In general, these habitats include caves, abandoned mines, bridges, or structures. Measures such as seasonal or permanent access restrictions should be considered, especially during critical life history periods in occupied habitat within high public use areas. When designing or maintaining bridges, project coordinators should consider incorporating design elements that allow for the use of structures by bats or improve the potential for roost habitat.
- **Guidelines (FW-GDL-ARS 7):** Site-specific information should be used to determine if management activities may potentially impact species of conservation concern. Species-specific mitigation and protective measures should be incorporated into project design to ensure persistence of species (for example, retention of both abiotic and biotic features required for essential life history characteristics, such as breeding and foraging).

For Rocky Mountain bighorn sheep, the primary threat is disease. The following standard would mitigate disease contraction within the plan area, however it is still possible stray animals could wander onto forest service lands.

- **Standards (FW-STD-GR 4)**: Grazing of domestic sheep or goats shall not be authorized in areas occupied by bighorn sheep to mitigate the potential transfer of disease from domestic sheep to bighorn sheep.

Determination: For all species that use cliff, caves, mines, and rocky features, the ecosystem-level plan components may not provide the ecological conditions necessary to maintain viability in the plan area. Therefore, additional species-specific plan components have been provided. The combination of ecosystem-level and species-specific plan components should provide the ecological conditions necessary to maintain viability in the plan area for American peregrine falcon, pale Townsend's big-eared bat, Arizona myotis, and Mexican spotted owl.

It is beyond the authority of Forest Service personnel or not within the inherent capability of the plan area to maintain or restore the ecological conditions to maintain viability for Rocky Mountain bighorn sheep. Nonetheless, the ecosystem-level and species-specific plan components should maintain or restore ecological conditions within the plan area to contribute to maintaining viability of the species within its range.

Multiple Vegetation Types

Some species, like American peregrine falcon and Mexican gray wolf use, a variety of habitats. Key ecological conditions for the falcon were addressed above under cliffs and rocky features. For the wolf, the key ecological conditions include large landscapes and connected habitat and adequate prey base. These needs would be provided for through plan components under terrestrial species habitat and the infrastructure, roads and sustainable ranching and livestock grazing program areas. Key plan components that would benefit the wolf include those that minimize harassment and improve connectivity and movement of the wolf and or its prey (FW-DC-TRSP 10-11; FW-GDL-TRSP 3; FW-STD-GR 2; FW-DC-RD 6). Several management approaches (1 and 3 below) for at-risk species would further help to provide persistence for the wolf throughout its range by promoting collaborative partnerships to aid in recovery and delisting and to consider habitat fragmentation on adjacent lands when planning activities on the Cibola National Forest. They include the following:

- Maintain strong partnerships between State and Federal agencies, Tribal governments, academia, and nongovernment organizations to provide for federally recognized species and species of conservation concern.
- Emphasize the protection and replacement of key habitats that contain threatened and endangered plants and animals, species of conservation concern plants and animals, or both. Work with the U.S. Fish and Wildlife Service and other partners to develop conservation measures (for example, public education to reduce human impacts) to prevent listing and to aid in the recovery and delisting of federally listed species. For 10(j) species, such as the Mexican wolf, this applies inside and outside the designated experimental range.
- Acknowledge fragmentation can occur at different temporal and spatial scales. At-risk species management approach should consider activities occurring simultaneously within at-risk species habitat as well as activities occurring on adjacent land that may impact species. The Cibola can serve as important refugia to at-risk species; therefore, project analysis of impacts to habitat should include multiple spatial and temporal scales, and cumulative monitoring should be included in project design.

Determination: The ecosystem plan components should provide the ecological conditions necessary to maintain viability of the Mexican gray wolf in the plan area. No additional species-specific plan components are warranted.

Environmental Consequences – Alternative B

Summary

Alternative B retains relevant plan direction from alternative A but is more responsive to current science than the existing plan and addresses the core themes and significant issues explored during the plan revision process. The primary difference between alternative B and the other alternatives is the addition of 10 site-specific management areas with their own unique plan components. These include management areas for specific places by ranger district. Under this alternative, effects of lack of vegetation management are expected to be concentrated in wilderness and place-based management areas.

Alternative B does not contain the broad-based conservation and restoration management areas as proposed in alternative C. All other plan components would remain the same as those listed under all action alternatives except for variation among management objectives and the following site-specific plan components.

Proposed management areas under alternative B are listed below. There are no restoration or conservation management areas.

- Mount Taylor District: Mount Taylor, Fort Wingate, Little Water Canyon and Guadalupe
- Magdalena District: Silver Hill Dark Skies, Pueblo Migrations
- Mountainair District: Fourth of July Canyon, Jumanos Pueblos, Cement Springs
- Sandia District: Las Huertas Canyon

The proposed management areas that could have the highest impact on wildlife are Mount Taylor and Little Water Canyon. A number of desired conditions and guidelines would help maintain species viability in particular species that use grassland, shrublands, and riparian systems.

Mount Taylor Management Area

- **Desired Condition (MA-DC-MTT 3):** The area provides a functional ecosystem that contributes primary sources of surface and groundwater for drinking water to communities and domestic and agricultural purposes, functions as a biological stronghold for Mexican spotted owl, and provides opportunities for remoteness and solitude.

Little Water Canyon Management Area

- **Desired Condition (MA-DC-LWC 1):** The area represents an outstanding biologically diverse area. The unique ecological and biological integrity of the Colorado blue spruce forest/red osier dogwood plant association represent a relic of colder and moister conditions and persists in a near pristine condition.
- **Desired Condition (MA-DC-LWC 2):** The area contains very few nonnative species and provides a high level of species diversity exemplified by species unique to this area (for example, water birch, orchids, fish, clams). Plant community compositions are unaltered.

- **Desired Condition (MA-DC-LWC 3):** The spring and stream provide substantial flows that are rare in the Zuni Mountains. The spring and stream, coupled with the vegetation, provide microhabitats that are extremely important to aquatic and wildlife habitat.
- **Standards (MA-STD-LWC 2):** Livestock grazing will be managed to maintain the high biodiversity of the area.
- **Standards (MA-STD-LWC 3):** Restoration treatments (for example, thinning and prescribed burning) will not occur unless these practices provide for maintenance of the unique biodiversity of the area.

In addition to the environmental consequences for all alternatives above, alternative B would primarily differ from alternative A in the rate and magnitude of habitat treated for riparian-dependent species and species affected by fire-adapted ecosystem. Plan direction under this alternative would focus on site-specific, place-based management areas. Fire effects would be similar to alternative A with improved plan components that take a holistic approach to fire and fuels management; however, this alternative would make slower progress toward meeting desired conditions because of lack of vegetation management in wilderness and place-based management areas. Those areas would not use mechanical treatments.

Mixed-conifer and ponderosa pine habitat is moderately to highly departed from reference conditions and trending away, and this trend would continue (See "Affected Environment" above and the "Vegetation" section). Alternative B would maintain the current rate of mechanical treatment (2,000 to 5,000 acres annually) but would increase the current rate of prescribed fire (4,200 to 12,000 annually) and would substantially increase the use of managed wildfire (2,200 to 5,500 acres annually). This is the same as alternative D, more than A, but less than C.

Under 15 years, desired conditions for mixed conifer would remain moderately departed but would move closer to the desired state, changing from of departure of 58 percent to 50 percent. Ponderosa pine would remain highly departed (69 percent)—a slight improvement from current conditions (77 percent departure). This would be a slight improvement over alternative A for species that depend on fire-adapted ecosystems but less than alternative C.

To restore the watershed condition framework and contribute to resilient and health ecosystems, alternative B would include objectives such as relocating, improving, or decommissioning 1 to 3 miles of system roads or unauthorized routes annually. This would be slightly more beneficial to riparian-dependent species than alternative A, less than alternative C, and the same as alternative D.

This alternative would recommend 55,779 acres of additional wilderness, more than alternative C (24,265) and A but less than alternative D (203,117). Additional wilderness would minimize disturbance and have positive effects for species that need connected landscapes like the wolf. However, Cibola National Forest personnel would also be more limited in their ability to mechanically treat these areas and would rely on wildland fire as the main restoration tool. There is general consensus in the literature that treatments which use burning or thinning alone are less effective than treatments that use burning and thinning (Kalies and Kent 2016).

There is one standard proposed for the Guadalupe area to not permit livestock grazing due to accessibility issues and low production; this is the current management standard applied to the area and would continue to benefit wildlife.

The implementation of 1 to 2 watershed improvement projects and 10 to 15 range improvement projects annually could improve riparian areas or aquatic structures if they are selected for improvement. Guidance provided in alternative B for riparian areas provides clearer direction than alternative A for ensuring proper functioning condition is maintained or improved and is the same as alternatives C and D (with exceptions as noted above).

Federally Listed Species

Mexican Spotted Owl

The owl would benefit from the plan components listed under all the action alternatives; however, optimal habitat for nesting and roosting varies.

For the owl, based on VDDT modeling, it is estimated the amount of mixed conifer available for nesting and roosting would increase slightly in 15 years from 10 to 23 percent (15,308 acres to 36,211 acres) and ponderosa pine/Gambel oak stands would increase slightly from 8 to 17 percent of the Cibola (35,211 to 75,443 acres).

Overall nest and roost habitat for the owl would increase from 50,519 to 111,654 acres. This is slightly less than the other alternatives.

Table 97. Current and projected Mexican spotted owl habitat, alternative B

Vegetation Type	Current nest/roost	Nest/roost in 15 Years	Percent Change
PPO	35,211	75,443	+13
DMC	15,308	36,211	+9
TOTAL	50,519	111,654	+22

PPO = ponderosa pine/Gambel oak; DMC = dry mixed conifer

In addition to the plan components described under all action alternatives, the site-specific plan components (see above summary) under alternative B would further maintain species viability by promoting resilient habitat, natural fire regime, and balancing the needs of the owl with other multiple uses.

Determination: There could be some localized short-term adverse impacts to the owl and its critical habitat, but overall, species viability would be maintained. Beneficial impacts include a slight improvement in potentially suitable habitat in dry mixed conifer and ponderosa pine systems by increasing the amount of habitat in the desired seral states for breeding and foraging.

Mexican Gray Wolf

Under alternative B, forage production and availability would increase as result of increased used of wildfire (both natural and prescribed). Livestock distribution would improve and would result in improved vigor and abundance of herbaceous vegetative conditions, which would also benefit other ungulates such as large elk which are prey for Mexican wolf. Roads would also be decommissioned at a higher rate than alternative A which would decrease negative interactions with vehicles and improve connectivity.

Determination: While some individuals could be impacted by actions on the Cibola, the alternative management activities would not adversely affect the viability of the species. Overall, species viability would be maintained. Beneficial impacts include a slight improvement in connectivity by decreasing the amount of roads and potential increases in prey base.

Chiricahua Leopard Frog, Alamosa Springsnail, Yellow-Billed Cuckoo, Southwestern Willow Flycatcher

Structural improvements (for example, water, fences) would increase to 10 to 15 annually, road decommissioning to improve ecosystems and watersheds would increase to 5 to 7 miles annually, and water resource improvement projects would include 1 to 2 projects. These objectives would help to offset any sedimentation and ash discharge resulting from wildfires (both managed and prescribed) and mechanical treatments. These objectives would benefit riparian dependent associates. Plan components discussed under all action alternatives would help to offset any potentially adverse effects form these actions. Desired conditions would be achieved at a faster rate than alternative A but slower than the other alternatives. Alternative B would have the second poorest outcome for improving fire regime condition class and wetland integrity and the second poorest outcome for improving stream health and riparian habitat (see "Water Resources" section).

Determination for southwestern willow-flycatcher and yellow-billed cuckoo: While some individuals could be impacted by actions on the Cibola, the alternative management activities would not adversely affect the viability of the species. Overall, species viability would be maintained. Viability for these species would be maintained but there would be very limited change to riparian habitat quality.

Determination for Alamosa springsnail and Chiricahua leopard frog: There could be some short-term localized adverse impacts to the Alamosa springsnail and the Chiricahua leopard frog and its critical habitat. Overall, species viability would be maintained. However there would be very limited change to riparian or spring habitat quality.

Zuni Bluehead Sucker

There are four site-specific management areas on the Mt. Taylor Ranger District, and two of those management areas are on the Zuni Mountains. Little Water Canyon Management Area is more than 10 miles away from Zuni bluehead sucker locations. It also is outside of the 6th-level hydrologic unit code subwatersheds that the species inhabits. The second management area, Ft. Wingate, is approximately 10 miles away from fish species locations and is also outside of their 6th-level subwatersheds. Each management area is also outside Zuni bluehead sucker designated critical habitat.

Determination: Management areas plan components are not expected to have any effect to the Zuni bluehead sucker or its critical habitat.

Zuni Fleabane

The Zuni fleabane would benefit from the plan components listed under all the action alternatives; however, soil conditions vary from site to site. According to the vegetation report, pinyon-juniper is supposed to move from a moderate departure to a low departure, which means the Zuni fleabane should see an improvement in overall conditions. Soil conditions unknown within pinyon-juniper areas.

Determination: There could be some localized impacts to individual plants, but overall, species viability would be maintained. Beneficial impacts include a slight improvement in potentially suitable habitat in pinyon juniper by improving the overall soil condition.

Sensitive Species

Sensitive species that depend on fire-adapted ecosystems would benefit from plan components described under all action alternatives, however, optimal habitat for each species varies based on differing plan objectives for vegetation management.

Forest Ecosystems Including Fire-Adapted Ecosystems (Ponderosa Pine Forest and Dry Mixed Conifer Vegetation Types

Based on VDDT modeling, the following shows the change in frequent fire habitat conditions in 15 years:

Ponderosa Pine Forest

- Goshawk habitat would increase from 10 percent to 23 percent (44,272 to 105,967acres).
- Allen's lapped-browed bat habitat, Arizona myotis habitat, and bald eagle habitat would increase from 38 percent to 46 percent (173,088 to 210,977 acres)

Dry Mixed Conifer

- Goshawk habitat would increase from 10 to 26 percent (16,319 to 40,158 acres).
- Allen's lapped-browed bat habitat would increase from 32 to 46 percent (50,630 to 72,721 acres)

Table 98. Current and projected sensitive species habitat in fire-adapted ecosystems, alternative B

Vegetation Type	Species	Current	15 Years	Percent Change
PPO	Goshawk	44,272	105,967	+13
DMC	Goshawk	16,319	40,158	+16
PPO	Allen's lapped-browed bat habitat, Arizona myotis habitat, bald eagle habitat	173,088	201,977	+8
DMC	Allen's lapped-browed bat	50,630	72,721	+14

PPO = ponderosa pine/Gambel oak, DMC = dry mixed conifer

Overall habitat for goshawk would increase from 60,591 acres to 146,125 acres. Overall habitat for bald eagle and Arizona myotis would increase from 173,088 acres to 201,977 acres and overall habitat for Allen's lappet browed bat would increase from 223,718 acres to 274,698 acres.

Optimal habitat for the goshawk, would be slightly more than alternative A but less than C. For bald eagle, Allen's lappet-browed bat, and Arizona myotis, habitat would be more for this alternative than the others (table 91 and figure 16).

Determination: Based on the analysis of plan components and the amount of habitat provided for each of the above species, viability would be maintained for each of these species dependent on conifer habitat under alternative B. While individual animals could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of bald eagle, Allen's lappet-browed bat, and Arizona myotis. Beneficial effects include improvements in nesting, roosting and foraging habitat.

Villous groundcover milkvetch and Sandia Mountain alumroot: The management areas under this alternative that have plan components are expected to improve habitat for these two species, particularly the management areas within Ponderosa Pine Forest and Dry Mixed Conifer vegetation types. The overall habitat for villous groundcover milkvetch and Sandia Mountain alumroot is expected to increase. Soil condition is expected to improve in 1 to 2 project areas annually in priority watershed areas and on 10,000 acres annually of vegetation projects in Ponderosa Pine Forest and Dry Mixed Conifer vegetation types (see "Soil" section).

Determination: Based on the analysis of plan components and the amount of habitat provided for villous groundcover milkvetch and Sandia Mountain alumroot, viability would be maintained for each species dependent on Ponderosa Pine Forest and Dry Mixed Conifer vegetation types under alternative B. While individual plants could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing. Beneficial effects include improvements in soils is expected which could improve the overall health to each species.

Riparian and Aquatic Associated Species

- Bald eagle
- Dumont's fairy shrimp
- Northern leopard frog
- Allen's lappet browed bat
- Spotted bat
- Pale Townsend's big-eared bat
- Rio Grande chub
- Rio Grande sucker

Sensitive species that depend on riparian or wetland habitat would benefit from the plan components described under all action alternatives. There could be a slight increase in quality of habitat as projects come on line with current objectives to improve water resource features (1 to 2 annually) and structural improvements (10 to 15 annually). Desired conditions would be achieved at a faster rate than alternative A but slower than the other alternatives.

Little Water Canyon Management Area is approximately 2 miles away from Rio Grande chub and Rio Grande sucker locations, and a portion of the management area occurs within the Agua Medio-Bluewater Creek watershed. Plan components (MA-STD-LWC) could have positive impacts on both fish species.

Alternative B will have the second poorest outcome for improving fire regime condition class and wetland integrity and the second poorest outcome for improving stream health and riparian habitat (see "Hydrology" section).

Determination: Based on the analysis of plan components and the amount of habitat provided for each of the above species, viability would be maintained for each of these species dependent on riparian and aquatic habitat under alternative B. While individual animals could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species.

Nonforest-Dependent Species (Grassland/ Shrubland and Pinyon Juniper Vegetation types)

Special Habitat Features (Cliffs and Rocky Features, Soils/Burrows)

- Pale Townsend's big-eared bat
- Spotted bat
- Gray vireo
- American peregrine falcon
- Burrowing owl
- Gunnison's prairie dog

Fuelwood would be offered at the same rate as alternatives A and D and effects on pale Townsend's big-eared bat, spotted bat, gray vireo, and American peregrine falcon would be the same. Livestock distribution would increase slightly under this alternative, improving herbaceous vegetative conditions. This would lead to increased plant cover for small mammals and improved foraging condition and soils. This would have beneficial effects on burrowing owl and prairie dog.

Determination: Based on the analysis of plan components and the amount of habitat provided for each of the above species, viability would be maintained for each of species dependent on Grassland/Shrubland and Pinyon Juniper habitat. While individual animals could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species.

Zuni milkvetch and Sivinski's fleabane: The management areas under this alternative that have plan components are expected to improve habitat for these two plant species, particularly the management areas within Colorado Plateau/Great Basin and Pinyon Juniper vegetation types. Fuelwood would be offered at the same rate as alternatives A and D, and effects on Zuni milkvetch and Sivinski's fleabane would be the same. Livestock distribution would increase slightly under this alternative, improving herbaceous vegetative conditions. This would lead to increased plant cover and soil conditions.

Determination: Based on the analysis of plan components and the amount of habitat provided for Zuni milkvetch and Sivinski's fleabane, viability would be maintained dependent on Colorado Plateau/Great Basin and Pinyon Juniper habitat. While individual plants could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species.

At-Risk Species-Species of Conservation Concern

Effects to at-risk species from desired conditions, standards, and guidelines are described under all action alternatives. Effects from plan components would be the same with the exception of the Fort Wingate Management Area for sheep study. The Ft. Wingate Management Area for sheep study is outside any bighorn sheep habitat, and suitable habitat does not occur in the west Zunis for bighorn sheep. In the unlikely event animals were to intermingle, the following guideline (in addition to forestwide direction—FW-STD-GR-4) would provide for species viability:

MA-GDL-FTW:

1. Domestic sheep grazing should be allowed as part of a demonstration of sustainable management and conducted consistent with sustainable practices to protect sensitive soils and wildlife habitat.

Additional site-specific plan components that would benefit at-risk species under alternative B are described at the beginning of this section and are largely focused on riparian and watershed and grazing management and restoration of fire-adapted ecosystems.

The primary different between alternatives is for objectives and the amount of habitat restored for fire adapted ecosystems and riparian improvements and the amount of habitat designated as wilderness (the second least amount of acreage proposed). Threats to at-risk species can be found under all action alternatives.

Forested and Fire-Adapted Ecosystems (Ponderosa Pine Forest and Dry Mixed Conifer Vegetation Types: DMC, PPF, SFF, MCW, MPO)

Mexican spotted owl, northern goshawk, red-faced warbler, Graces' warbler, Arizona myotis, American peregrine falcon, Lewis's woodpecker*

Species that use forested and fire-adapted ecosystems would benefit from objectives realized through the vegetation and fire and fuels management program areas. Under alternative B, ecological conditions would improve and trend toward reference conditions.

Overall habitat for the majority of species of conservation concern that use both ponderosa pine and dry mixed conifer would increase from 60,591 acres to 146,125 acres. Overall habitat for Arizona myotis would increase from 173,088 acres to 291,977 acres (ponderosa pine only).

Under alternative B, more optimal habitat would be restored for species of conservation concern that use fire adapted ecosystems than alternatives A, but less than alternative C and D. Arizona myotis, however, would realize more optimal habitat under alternative B than under the other alternatives. This may reflect a greater preponderance of smaller trees under this alternative than the others.

Tree Features including Large Trees, Cavities, Snags, Leaves, Bark, Downed Logs, Leaf, or Forest Litter (PPF, DMC, SFF, MCW, MPO, MMS, PJG, PJO, Riparian):

Mexican spotted owl, Lewis's woodpecker, northern goshawk, red-faced warbler, Graces' warbler, juniper titmouse, gray vireo*

Effects to at-risk species that use tree features in forested and fire-adapted ecosystems would be similar to those outlined above. Species that also use riparian systems (Mexican spotted owl, Lewis's woodpecker, red-faced warbler, Arizona myotis) could benefit from objectives to improve water resources at a rate of 1 to 2 projects focused in priority watersheds annually. Ecological conditions would be improved from current conditions, would be improved at a slightly faster rate than alternative A but at the slower rate than alternatives C and D. Species that could be affected by fuelwood collection of large trees include juniper titmouse and gray vireo. They could be affected by objectives under the sustainable forestry and forest products program. Fuelwood would be available at the current rate (9,000 to 12,000 cords annually—same as alternatives A and D).

Riparian or Aquatic Systems (Riparian Habitat, Seeps/Springs, Wetlands, Stock Tanks/Drinkers)

Arizona myotis, Dumont's fairy shrimp, red-faced warbler, Lewis's woodpecker, Mexican spotted owl. southwestern willow flycatcher,* western yellow-billed cuckoo,*Alamosa springsnail,* Chiricahua leopard frog,* northern leopard frog, Rocky mountain bighorn sheep, Zuni bluehead sucker*, Rio Grande chub, and Rio Grande sucker*

Species of conservation concern that depend on riparian or wetland habitat would benefit from the plan components described under all action alternatives. There could be a slight increase in quality of habitat as projects come on line with a current objectives to improve water resource features (1 to 2 annually) and structural improvements under the sustainable grazing and range program area (10 to 15 annually).

Objectives to relocate, improve, or decommission 1 to 3 miles of roads annually would help to minimize disturbance and sedimentation. Overall, desired conditions for species that depend on riparian aquatic systems would be achieved at a faster rate than alternative A but slower than alternative C; the effects would be similar to alternative D.

Little Water Canyon Management Area is approximately 2 miles away from Rio Grande chub and Rio Grande sucker locations, and a portion of the management area occurs within the Agua Medio-Bluewater Creek watershed. Plan components (MA-STD-LWC) could have positive impacts on both fish species.

Alternative B will improve conditions and provide for the persistence of at-risk species associated with departed riparian systems. However, the rate of achieving desired habitat conditions for improving fire regime condition class and water resource integrity would be slower than the remaining action alternatives (see "Water Resources" section).

Nonforested Vegetation (PJO, JUG, MSG, CPGB, SDG, CDS, SAGE, MMS)

Aplomado falcon, Gunnison's prairie dog, burrowing owl, Rocky Mountain bighorn sheep, gray vireo, loggerhead shrike, Bendire's thrasher, juniper titmouse, *Zuni fleabane, Zuni milkvetch, and Sivinski's fleabane.*

Fuelwood would be offered at the same rate as alternatives A and D, and effects on pale Townsend's big-eared bat, gray vireo, loggerhead shrike, and juniper titmouse would be the same. Livestock distribution would increase slightly under this alternative, improving herbaceous vegetative conditions. This would lead to increased plant cover for small mammals and improved foraging condition and soils. This would have beneficial effects on burrowing owl, prairie dog, and Bendire's thrasher. There are no objectives for the other nonforested vegetation types, and the effects to species that use those systems are described under the all action alternatives section. There would be no changes in habitat quantity or quality between alternatives.

Abiotic and Rocky Features

Rocky Mountain bighorn sheep, American peregrine falcon, pale Townsend's big-eared bat, Arizona myotis, and Mexican spotted owl.

Effects to species that use abiotic and rocky feature are described under all action alternatives. There would be no changes in habitat quantity or quality between alternatives.

Environmental Consequences – Alternative C

Summary

Alternative C is more responsive to Issue 3: Ecological resilience—restoration of fire-adapted ecosystems and sustainability of springs, wetlands, and riparian areas (improved watershed health). There is an emphasis on connectivity and more timely and effective treatment of noxious weeds which have the capacity to impair ecosystem integrity and function, out compete native species, and alter the natural fire regime. An increased emphasis on restoration intensity emphasizes partnerships to get more work done on the ground to achieve desired conditions at greater rate than the other alternatives. This should benefit most species that depend on fire adapted and riparian ecosystems by improving habitat at a faster rate and intensity in areas that need it most.

Very little new wilderness (24,265 acres) would be designated under this alternative; this is less than alternatives B and D. This alternative would maximize the Cibola's ability to use both mechanical and wildland fire to treat the areas currently at high risk from drought, fire, and bark beetle outbreaks. A caveat to this would be proposed wilderness and conservation management areas which would not use mechanical treatment. Treatments by burning or thinning alone can be less effective or ineffective at reducing fire risk (Kalies and Kent 2016). Alternative C is the only action alternative with conservation and restoration management areas. There are slightly more acres unsuitable for timber production (1,529,599) than alternative A but less than B and D.

A key difference between alternative C and the other alternatives is the addition of two purpose-based areas (conservation and restoration management areas) with their own plan components (nested within the main plan components).

Proposed management areas under alternative C include the following:

- Conservation: Mt. Taylor District, Magdalena District (36,547 acres)
- Restoration: Magdalena District: Mountainair District, Sandia District (318,148 acres)

A number of desired conditions and guidelines (outlined below) would help maintain species viability in those areas by emphasizing the natural fire regime which would contribute to desired vegetation structure, connected ecosystems that promote healthy wildlife movement, and ecological conditions that are resilient to natural stressors. These plan components are unique to alternative C and in addition to forest-wide plan components described previously under the all action alternatives and appendices E and F (the species crosswalks).

Conservation Management Area

- **Desired Condition (MA-DC-CONS 3):** These areas consist of uninterrupted wildlife habitat where fire plays a vital role in overall habitat improvement, allowing for and encouraging the management of planned and unplanned ignitions across the landscape.
- **Guideline (MA-GDL-CONS 4):** Forest and vegetation management should be limited to wildlife habitat and range improvement projects with planned and unplanned fire as the primary tool where there is a demonstrated need.

Restoration Management Area

- **Desired Condition (MA-DC-REST 1):** Ecosystems are resilient to drought, insect and disease, and uncharacteristic wildfires.
- **Guideline (MA-GDL-REST 4):** Forest management should result in wildfires that are low- to mixed-severity surface fires that limit loss of structures or ecosystem function.

These restoration and conservation management areas would aim to complete 2 to 5 projects annually which could lead to moderate improvements in watershed resources and associated habitat for riparian and aquatic dependent species.

From a watershed and aquatic species perspective, alternative C would be best since it would complete 3 to 5 miles of road infrastructure improvements (relocate, improve, or decommission) which is the most of any alternative. Alternative C would also have the greatest number of sustainable grazing and range projects of any alternative (15 to 20 annually) which would have beneficial effects on aquatic species and riparian dependent species. Guidance provided in alternative C for riparian areas provides clearer direction for ensuring that proper functioning condition is maintained or improved.

Alternative C would also differ from alternative A in the rate and magnitude of habitat treated for those species dependent on fire-adapted ecosystems, large trees and snags, and riparian and aquatic ecosystems. Alternative C uses mechanical thinning, wildfire (managed and prescribed) and fuelwood collection at a greater intensity than any other alternative. It also makes the most use of partnerships to increase intensity of restoration treatments presenting the greatest opportunity for shared stewardship. As a result, the overall threat from stand-replacing wildfire in the ponderosa pine and dry mixed conifer ecosystems would be decreased and ecosystem function would be improved the fastest of any alternative. This decrease in uncharacteristic high-severity wildfire would also reduce soil erosion, sedimentation, and the chance of flash flooding following uncharacteristic fire events.

Alternative C addressed species needs at the fine, mid and broad scales. Vegetation and fuels reduction treatments would be strategically placed in the areas that are most at risk and in need of active restoration management. Plan components as mentioned above would ensure that wildlife needs would be considered in the planning process.

Alternative C would mechanically treat more acres of fire-adapted ecosystems than any other alternative (2,800 to 7000 acres annually) for an increase of 42,000 to 105,000 in suitable acres of habitat over the 15-year life of the plan. Alternative C would treat more acres using prescribed fire and managed wildfire than any other alternative. Objectives for prescribed burns include treating 4,900 to 14,000 acres annually (up to 210,000 acres over the life of the plan) and managing another 2,400 to 6,000 acres of naturally ignited wildfires (up to 90,000 acres in 15 years).

Much of the focus of the marked increase in prescribed fire following mechanical treatment under this alternative would be in wildland-urban interface areas as compared to alternative A. Treatments in conservation management areas, however, would be limited to wildfire (planned and unplanned).

Under this alternative, in 15 years, desired conditions for mixed conifer would remain moderately departed but would move closer to the desired state, changing from of departure of 58 percent to 49 percent. Ponderosa pine would remain highly departed (67 percent)—a moderate improvement from current conditions (77 percent departure). For species that use fire-adapted ecosystems (Mexican spotted owl, northern goshawk, bald eagle, Allen’s lappet browed bat, Grace’s warbler, red-faced warbler, Lewis's woodpecker and Arizona myotis), this alternative would realize the greatest overall improvement in habitat quality out of all alternatives.

The effectiveness of these treatments under alternative C would result in reduced risk of uncharacteristic wildfire events. In addition to reducing fire risk in fire-adapted ecosystems, restoration treatments would also decrease impacts to riparian areas through positive changes to adjacent upland areas and a decreased direct risk of fire in riparian areas. Riparian management zones would provide for targeted treatments in these areas while protecting riparian values (see the “Water Resources” section for more information).

There are no objectives to treat pinyon-juniper under any alternative; however, more fuelwood permits would be offered under this alternative than any other (12,000 to 15,000 annually). This could impact cavity- and snag-dependent species such as gray vireo, juniper titmouse, and pale Townsend’s big-eared bat that utilize mature stands in pinyon-juniper. However, permits would be issued on a case-by-case basis to mitigate this risk.

Under alternative C, more roads would decommissioned than the other alternatives (3 to 5 annually) which would be beneficial for wide-ranging species and species that need connected habitats. This would also benefit riparian species that could be negatively impacted by sediment transport and deposition. Additionally, it would reduce the amount of roads that are available for the spread in invasive plant species.

Alternative C would improve water resource features (for example, riparian areas, springs, streams) or soils by implementing at least 2 to 5 projects annually. This would be more than alternatives A and B and the same as alternative D (with the exception of the addition of restoration management areas under alternative C).

Federally Listed Species

Mexican Spotted Owl

Overall vegetation departure under this alternative would trend more toward reference conditions than under any other alternative. Intensified treatments would decrease canopy cover continuity at the landscape scale and reduce ladder fuels which contribute to uncharacteristic fires. Enhancements in vegetation structural state which reduce smaller trees and ultimately improve conditions for large tree growth which would in turn promote low-intensity ground fire. For the owl, based on VDDT modeling it is estimated the amount of mixed conifer available for nesting and roosting would increase in 15 years from 10 to 23 percent (15,308 to 35,944 acres) and ponderosa pine/Gambel oak stands would increase from 8 to 17 percent of the Cibola (35,211 to 75,717 acres). Overall, potential nesting or roosting habitat would increase from 50,519 to 111,661 acres. This is slightly more than alternative B but slightly less than A and D. Although this alternative would treat more total acres of pine and mixed conifer than the others, more treatments would occur in the wildland-urban interface. In addition, this alternative would include a slight expansion of the Apache Kid Wilderness and Manzano Wilderness which include designated critical habitat and nest or roost areas for the owl. This would minimize disturbance, but restoration action would be limited to the use of wildland fire in those areas. See the map packet for the alternative C map that includes recommended wilderness areas and the Mexican spotted owl maps.

Table 99. Current and projected Mexican spotted owl habitat, alternative C

Vegetation Type	Nest/roost current	Nest/roost in 15 Years	Percent Change
PPO	35,211	75,717	+9
DMC	15,308	35,944	+13
TOTAL	50,519	111,661	+22

PPO = ponderosa pine/Gambel oak, DMC = dry mixed conifer

In addition to the plan components described under all action alternatives, the plan components (see above summary) for the conservation and restoration management areas would further maintain species viability by promoting resilient habitat and natural fire regime and balancing the needs of the owl with other multiple uses.

Determination: Based on the analysis of plan components and the amount of habitat provided for nesting and roosting, there could be some short-term localized adverse impacts to the owl and its critical habitat. Overall, species viability would be maintained. Beneficial impacts include a slight to moderate improvement in potentially suitable habitat in dry mixed conifer and ponderosa pine systems by increasing the amount of habitat in the desired seral states for breeding and foraging.

Mexican Gray Wolf

Although the addition of wilderness acres is more limited than alternatives B and D, the additional acreage would still improve connectivity for wide ranging species including the wolf and decrease the potential for negative human interactions. Under alternative C, there would be 3 to 5 miles of road decommissioned annually—the most of any alternative. This would help limit disturbance and negative human interactions with the wolf, including vehicle collisions. According to the "Range" section, forage availability would increase over time as a result of intensified vegetation and fire treatments. This would have beneficial impacts on big game species which would be positive for the wolf. These beneficial effects would be more than alternative A and B.

Determination: While some individuals could be impacted by actions on the forest the alternative management activities would not adversely affect the viability of the species. Overall, species viability would be maintained. Beneficial impacts include a moderate improvements in connectivity by decreasing the amount of roads and substantial increases in forage conditions for prey.

Chiricahua Leopard Frog, Alamosa Springsnail, Yellow-Billed Cuckoo, Southwestern Willow Flycatcher, and Zuni Bluehead Sucker

Under alternative C, there would be moderate improvements to the watershed (fire regime condition class) resulting from increased objectives for prescribed fire and mechanical treatments as described above for the owl. These improvements would also benefit riparian-dependent species by decreasing the risk from uncharacteristic stand-replacing fire and the resulting sedimentation which could negatively affect spawning and foraging habitat for the Zuni bluehead sucker. In addition, there would be 3 to 5 miles of road decommissioned annually (more than any other alternative) which would also have beneficial impacts on sedimentation and discharge which can negatively affect riparian habitat. There is also an objective for 15 to 20 structural improvements annually which could benefit species that utilize tanks and springs. Objectives for water resources would prioritize 2 to 5 projects annually which would move those systems closer to desired conditions at a slightly faster rate than alternatives A, B, and D. This could include activities that improve the natural flood regime and contribute to native plant species composition and structure and ephemeral and perennial water supplies. Due to the proximity of the frog and springsnail to the Cibola, there is the potential for some short-term adverse effects (for example, soil compaction, sedimentation, ash deposition) resulting from mechanical treatments and managed fire. In the long term, restoration activities would improve habitat condition. The addition of 24,265 acres of recommended wilderness areas would also limit mechanical activities that can negatively affect riparian areas through soil compaction and erosion.

Determination for southwestern willow-flycatcher, yellow-billed cuckoo, and Zuni bluehead sucker: Based on the analysis of plan components and the amount of habitat provided for each of the above species, viability would be maintained for each of these species dependent on riparian and aquatic habitat under alternative C. While some individuals could be impacted by actions on the Cibola, the alternative management activities would not adversely affect the viability of the species. Beneficial impacts include a slight improvement in potentially suitable habitat in riparian or aquatic systems resulting from improved hydrology as a result of increased treatment rates in the Dry Mixed Conifer and Ponderosa Pine Forest vegetation types. The lower risk from uncharacteristic wildfire would also decrease negative effects from associated sedimentation and ash discharge which can occur as a result of this these types of events.

Determination for Alamosa springsnail and Chiricahua leopard frog: There could be some short-term localized adverse impacts to the Alamosa springsnail and the Chiricahua leopard frog and its critical habitat, but overall, species viability would be maintained. There would be a slight improvement in riparian and spring habitat quality for these species in the long term.

Zuni Fleabane

In addition to the plan components described under all action alternatives, the plan components (see above) for the management areas, conservation areas, and restoration areas would further maintain species viability by promoting resilient habitat and natural fire regime and balancing the needs to maintain a viable population.

Determination: Based on the analysis of plan components and expected improvement of pinyon juniper and possibly soil condition class overall, species viability would be maintained. Beneficial impacts include a slight to moderate improvement in potentially suitable habitat.

Sensitive Species

Forest Ecosystems Including Fire-Adapted Ecosystems (Ponderosa Pine Forest and Dry Mixed Conifer Vegetation Types)

Based on VDDT modeling, the following shows the change in frequent fire habitat conditions in 15 years:

Ponderosa Pine Forest

- Goshawk habitat would increase from 10 percent to 25 percent (44,272 to 112,755 acres).
- Allen's lapped-browed bat habitat, Arizona myotis habitat, and bald eagle habitat would in increase from 38 percent to 46 percent (173,088 to 208,745 acres)

Dry Mixed Conifer

- Goshawk habitat would increase from 10 percent to 26 percent (16,319 to 40,959).
- Allen's lapped-browed bat habitat would increase from 32 percent to 47 percent (50,630 to 73,586 acres).

For species that use fired-adapted systems, overall vegetation departure under this alternative would trend more toward reference conditions than any other alternative. Overall optimal habitat for goshawk would increase from 60,591 acres to 153,714 acres. Overall habitat for bald eagle and Arizona myotis would increase from 173,088 acres to 208,745 acres and overall habitat for Allen's lappet browed bat habitat would increase from 223,718 acres to 282,331 acres. Optimal habitat would increase the most for northern goshawk for this alternative but would be the least out of any alternative for bald eagle, Arizona myotis, and Allen's lapped browed bat. This likely reflects the greater emphasis on tree removal in the smaller diameter classes.

Table 100. Current and projected sensitive species habitat in fire-adapted ecosystems, alternative C

Vegetation Type	Species	Current	In 15 Years	Percent Change
PPO	Goshawk	44,272	112,755	+15
DMC	Goshawk	16,319	40,959	+16
PPO	Allen's lapped-browed bat habitat, Arizona myotis habitat, bald eagle habitat	173,088	208,745	+8
DMC	Allen's lapped-browed bat	50,630	73,586	+15

PPO = ponderosa pine/Gambel oak, DMC = dry mixed conifer

Determination: Based on the analysis of plan components and the amount of habitat provided for each of the above species, viability would be maintained for each of these species dependent on conifer habitat. While individual animals could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species.

Villous groundcover milkvetch and Sandia Mountain alumroot: The management areas under this alternative that have plan components are expected to improve habitat for villous groundcover milkvetch and Sandia Mountain alumroot, particularly in management areas within Ponderosa Pine Forest and Dry Mixed Conifer vegetation types. The overall habitat for villous groundcover milkvetch and Sandia Mountain alumroot is expected to increase. Soil condition is expected to improve in 2 to 5 project areas annually in priority watershed areas and on 12,400 acres annually of vegetation projects in ponderosa pine forest and dry mixed conifer (see "Soil" section).

Determination: Based on the analysis of plan components and the amount of habitat provided for each of the above species, viability would be maintained for each of these species dependent on Ponderosa Pine Forest and Dry Mixed Conifer vegetation types under alternative C. While individual plants could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species. Beneficial effects include improvements in soils which could improve the overall health of each species.

Riparian and Aquatic Associated Species (Includes Riparian Vegetation Types and Constructed and Natural Waters)

- Bald eagle
- Dumont's fairy shrimp
- Northern leopard frog
- Allen's lappet browed bat,
- Spotted bat
- Pale Townsend's big-eared bat
- Rio Grande chub
- Rio Grande sucker

Sensitive species that depend on riparian or wetland habitat and either constructed or natural waters would realize a modest improvement in habitat. Under alternative C, there would be 3 to 5 miles of road decommissioned annually which would have beneficial impacts on sedimentation and discharge, which can negatively affect riparian habitat by reducing natural flooding patterns. This is the most of any alternative. There is also an objective for 15 to 20 structural improvements annually under the range program which could also benefit species that utilize tanks and springs. In addition, objectives for water resources would prioritize 2 to 5 projects annually, which would move those systems closer to desired conditions at a slightly faster rate than alternatives A and B. Under alternative C, moderate improvements to the watershed fire regime condition class resulting from increased objectives for prescribed fire and mechanical treatments would improve habitat quality.

Determination: Based on the analysis of plan components and the amount of habitat provided for each of the above species, viability would be maintained for each of these species dependent on aquatic and riparian habitat under alternative C. While individual animals could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species. Beneficial impacts include a slight improvement in potentially suitable habitat in riparian and spring areas resulting from improved water features, and hydrology as a result of increased treatment rates in the Dry Mixed Conifer and Ponderosa Pine Forest vegetation types. The lower risk from uncharacteristic wildfire would also decrease negative effects from associated sedimentation and ash discharge which can occur as a result of these types of events.

Nonforest Dependent Species (Grasslands, Shrubland, Pinyon Juniper Vegetation Types

Special Habitat Features: (Cliffs and Rocky Features, Soils/Burrows)

- Pale Townsend's big-eared bat
- Spotted bat
- Gray vireo
- Juniper titmouse
- American peregrine falcon
- Burrowing owl
- Gunnison's prairie dog

Under alternative C, there would be 12,000 to 15,000 more cords of wood offered annually, more than would be offered under any alternative. This could have negative effects on species such as the gray vireo, juniper titmouse, and spotted bat that utilize mature trees and snags for nesting and roosting. Locations of fuelwood offerings would be regulated through the Cibola permits on a case-by-case basis, which would mitigate this risk. This alternative would also realize the most improvement in herbaceous conditions and forage as a result of increased rates of fire and vegetation treatments. Livestock distribution would be substantially better under this alternative than the others, leading to increased plant cover and improved vegetation structure. This would lead to and improved foraging condition for small mammals and species that prey upon them. This would benefit grassland- and shrubland-dependent species like American peregrine falcon, burrowing owl, and Gunnison's prairie dog.

Determination: Based on the analysis of plan components and the amount of habitat provided for each of the above species, viability would be maintained for each of these species dependent on Grasslands, Shrubland, and Pinyon Juniper habitat under alternative C. While individual animals could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species.

Zuni milkvetch and Sivinski's fleabane: The management areas under this alternative that have plan components are expected to improve habitat for these two plant species, particularly the management areas within Colorado Plateau/Great Basin, and Pinyon Juniper. Fuelwood would be offered at the same rate as alternatives A and D, and effects on Zuni milkvetch and Sivinski's fleabane would be the same. Livestock distribution would increase slightly under this alternative, improving herbaceous vegetative conditions. This would lead to increased plant cover and improved soil conditions.

Determination: Based on the analysis of plan components and the amount of habitat provided for Zuni milkvetch and Sivinski's fleabane, viability would be maintained for each of species dependent on Colorado Plateau/Great Basin and Pinyon Juniper habitat. While individual plants could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species.

At Risk Species-Species of Conservation Concern

Effects to at-risk species from desired conditions, standards, and guidelines are described under all action alternatives. The primary difference between alternatives is for objectives and the amount of habitat restored for fire adapted ecosystems and riparian improvements, and the amount of habitat designated as wilderness (the most of any alternative). Threats to at-risk species can also be found under all action alternatives and in volume 2, appendices E and F (the species crosswalks).

Additional purpose-based plan components that would benefit at-risk species under alternative C are described under the summary beginning of this section.

Forested and Fire-Adapted Ecosystems (Ponderosa Pine Forest and Dry Mixed Conifer Vegetation Types: DMC, PPF, SFF, MCW, MPO)

Mexican spotted owl, northern goshawk, red-faced warbler, Graces' warbler, Arizona myotis, American peregrine falcon, Lewis's woodpecker*

Species that use forested and fire-adapted ecosystems would primarily benefit from objectives realized through the vegetation and fire and fuels management program areas. Under alternative C, ecological conditions would improve and trend toward reference conditions for all species.

Overall ecological conditions for the majority of species of conservation concern that use both ponderosa pine and dry mixed conifer would increase from 60,591 acres to 153,714 acres. Overall ecological conditions for Arizona myotis would increase from 173,088 acres to 208,745 acres (ponderosa pine only).

With the exception of Arizona myotis, alternative C would restore more optimal habitat for species of conservation concern that use fire-adapted ecosystems than any other alternative. Arizona myotis would realize the least amount of ecological conditions restored than under the alternatives, but conditions would still improve from current conditions. Optimal habitat for Mexican spotted owl would also improve from current conditions and those effects are described above under federally listed species.

Tree Features including Large Trees, Cavities, Snags, Leaves, Bark, Downed Logs, Leaf, or Forest Litter (PPF, DMC, SFF, MCW, MPO, MMS, PJG, PJO, Riparian):

Mexican spotted owl, Lewis's woodpecker, northern goshawk, red-faced warbler, Graces' warbler, juniper titmouse, gray vireo*

Effects to at-risk species that use tree features would be similar to forested and fire-adapted ecosystems as described above. Species that also use also use riparian systems (Mexican spotted owl, Lewis's woodpecker, Arizona myotis, red faced warbler, Lewis's woodpecker) would benefit from objectives to improve water resource features. This effects would be greater than the other alternatives. Alternative C would offer fuelwood at the highest rate (12,000 to 15,000) of any alternative. This could have negative effects on species such as the gray vireo and juniper titmouse that utilize mature trees and snags for nesting and roosting. However, locations of fuelwood offerings would be regulated through Cibola permits on a case-by-case basis, which would mitigate this risk.

Riparian or Aquatic Systems (Riparian Habitat, Seeps/Springs, Wetlands, Stock Tanks/Drinkers)

Arizona myotis, Dumont's fairy shrimp, red-faced warbler, Lewis's woodpecker, Mexican spotted owl. southwestern willow flycatcher,* western yellow-billed cuckoo,*Alamosa springsnail,* Chiricahua leopard frog,* northern leopard frog, Rocky mountain bighorn sheep, Zuni bluehead sucker*, Rio Grande chub, and Rio Grande sucker*

Species of conservation concern that depend on riparian or wetland habitat and either constructed or natural waters would realize a modest improvement in habitat. Under alternative C, there would be 3 to 5 miles of road decommissioned annually which would have beneficial impacts on sedimentation and discharge, which can affect riparian habitat. There would be more roads decommissioned under this alternative than any other. There is also an objective for 15 to 20 structural improvements annually, which could also benefit species that utilize tanks and springs. In addition, objectives for water resources would prioritize 2 to 5 projects annually, which would move those systems closer to desired conditions at a slightly faster rate than alternatives A and B. Under alternative C, moderate improvements to the watershed (fire regime condition class) condition class resulting from increased objectives for prescribed fire and mechanical treatments would improve habitat quality. Cumulatively, these objectives would move ecological conditions toward the desired state and improve ecological conditions.

Ecological conditions for federally listed species would also improve from current conditions and those effects are described above under federally listed species.

Nonforested Vegetation (PJO, JUG, MSG, CPGB, SDG, CDS, SAGE, MMS)

Aplomado falcon, Gunnison's prairie dog, burrowing owl, Rocky Mountain bighorn sheep, gray vireo, loggerhead shrike, Bendire's thrasher, juniper titmouse, *Zuni fleabane, Zuni milkvetch, and Sivinski's fleabane.*

Under alternative C, there would be 12,000 to 15,000 more cords of wood offered annually—more than would be offered under any alternative. This could have negative effects on species such as the gray vireo, and juniper titmouse that utilize mature trees and snags for nesting and roosting. However, locations of fuelwood offerings would be regulated through Cibola permits on a case-by-case basis, which would mitigate this risk. This alternative would also realize the most improvement in herbaceous conditions and forage as a result of increased rates of fire and vegetation treatments. Livestock distribution would be substantially better under this alternative than the others, leading to increased plant cover for small mammals, and improved foraging condition and soils. This would benefit grassland- and shrubland-dependent species like American peregrine falcon, burrowing owl, Gunnison's prairie dog, and Bendire's thrasher.

There are no objectives for the other nonforested vegetation types and the effects to species that use those systems are described under the all action alternatives section.

Abiotic and Rocky Features

Rocky Mountain bighorn sheep, American peregrine falcon, pale Townsend's big-eared bat, Arizona myotis, and Mexican spotted owl.

Effects to species that use abiotic and rocky feature are described under all action alternatives. There would be no changes in habitat quantity or quality between alternatives.

Environmental Consequences – Alternative D

Summary

Alternative D is more responsive to Issue #4: Sustainable Recreation This alternative prescribes less intensive management and places an emphasis on backcountry resources, with more recommended wilderness than any other alternative.at 203,117 acres. Many of these recommended wilderness areas lack recent mechanized and motorized vegetation treatments, which may result in more departed conditions than the vegetation community forestwide. As a result, vegetation conditions in these areas may be more vulnerable to uncharacteristic wildfire events. However, some recommended wilderness with lower vegetation departure or recent wildfire activity are less likely to need treatment and therefore would be less likely to be vulnerable to uncharacteristic wildfire events.

Under alternative D, the amount of mechanically treated acres for fire-adapted ecosystems would not differ from alternatives A and B. Prescribed burning (4,200 to 12,000 acres annually) and managed wildfires (2,200 to 5,000 acres annually) would occur at the same rate and magnitude as alternative B with a potential of 180,000 acres treated through prescribed burning and another 75,000 acres managed through naturally ignited wildfires over the life of the plan. This is more than alternative A but less than alternative C.

General, the increase in acres treated can be a benefit; however, treatments under this alternative are not likely to be as intensive as those in alternative C. This could result in more areas susceptible to uncharacteristic wildfire events. As noted in the "Fire and Fuels" section:

> "Alternative D decreases the intensity of restoration treatments. This alternative accepts larger risk across larger areas, such as allowing for more managed fire…The emphasis of natural ignitions playing a bigger role in ecosystems at the landscape level is greater than under the other alternatives. As a result, larger areas have the potential to trend toward the desired condition and function".

The range of mechanical treatment acreage is the same as alternatives A and B. Fire effects would be moderated under this alternative which would result in a decrease in stand-reduction fire.

There are no conservation manage areas or site-specific management areas in alternative D. Forestwide plan components would be the same as described above under "Environmental Consequences for All Action Alternatives." Like the other alternatives, alternative D uses mechanical thinning, fire and fuel wood collection to decrease risk from stand replacing wildfire. However because of the additional wilderness designations, this alternative would be more limited in its ability to mechanically treat vegetation in those areas prior to or after wildland fire management. Under this alternative, unplanned ignitions will be encouraged to play their natural role in ecosystems at the landscape level more than other alternatives. Current thinking on wilderness fire and its use has evolved over the last 50 years, and the scientific community now recognizes the beneficial effects lower intensity wildfire may have on forest structure and wildlife habitat (Millar et al. 2016). A caveat to this would be high-intensity, landscape-scale fires that would be detrimental to wildlife species that use fire-adapted systems. Thus the additional wilderness designations could have both beneficial and negative effects. The additional wilderness areas could limit the ability of Cibola personnel to treat areas that may be at immediate risk from stand-replacing wildfire, in turn increasing susceptibility of habitat loss for some species.

Under 15 years, desired conditions for mixed conifer would remain moderately departed but would move closer to the desired state, changing from of departure of 58 percent to 50 percent. Ponderosa pine would remain highly departed (69 percent), a moderate improvement from current conditions (77 percent departure). For species that depend on fire-adapted ecosystems, this alternative would be similar to alternative B in terms of overall habitat improved for these two vegetation types. However, the lack of mechanical treatment in wilderness could also put these species at greater risk for reductions of foraging, nesting, and roosting habitat resulting from stand-replacing wildfire.

To restore the watershed condition framework and contribute to resilient and health ecosystems, alternative D would include objectives such as relocating, improving, or decommissioning 1 to 3 miles of system roads or unauthorized routes annually. This would have slightly beneficial effects to riparian-dependent and wide-ranging species by limiting sediment deposition and human-wildlife interactions, better than alternative A but less than alternative C. Range improvements would occur at the same rate as alternative B (10 to 15 projects annually), more than A, and less than C. Water resource improvement projects would be at the same rate as alternative C (2 to 5 projects annually).

Fuelwood offerings would remain the same as alternatives A and B, so the effects to species that use large snags and trees in pinyon-juniper woodland would be the same.

Federally Listed Species

Desired conditions, standards, and guidelines for federally listed species were analyzed under all action alternatives. The following analysis account for differences in plan objectives and proposed wilderness.

Mexican Spotted Owl

Under this alternative, departure from desired conditions for ponderosa pine and dry mixed conifer would be similar to alternative B. This would be an improvement from current conditions but not as good as alternative C. For optimal habitat, based on VDDT modeling it is estimated that the amount of mixed conifer available for nesting and roosting would increase in 15 years from 10 to 23 percent (15,308 to 36,258 acres) and in ponderosa pine/Gambel oak stands would increase slightly from 8 to 17 percent of the Cibola (35,211 to 75,443 acres). Overall nest and roost habitat for the owl would increase from 50,519 to 111,710 acres. This is slightly more nest and roost habitat improvement than B and C but less than alternative A (see table 91 and figure 16).

Table 101. Current and projected Mexican spotted owl habitat, alternative D

Vegetation Type	Nest/roost current	Nest/roost in 15 Years	Percent Change
PPO	35,211	75,443	+9
DMC	15,308	36,258	+13
TOTAL	50,519	111,710	+22

PPO = ponderosa pine/Gambel oak, DMC = dry mixed conifer

Determination: Based on the analysis of plan components and the amount of habitat provided for nesting and roosting, there could be some short-term localized adverse impacts to the owl and its critical habitat, but overall, species viability would be maintained. Beneficial impacts include a slight to moderate improvement in potentially suitable habitat in dry mixed conifer and ponderosa pine systems by increasing the amount of habitat in the desired seral states for breeding and foraging.

Mexican Gray Wolf

The main difference between this alternative and the others that would benefit the wolf is it maximizes wilderness acres. This could benefit the wolf by minimizing fragmentation and human interaction and disturbance. However, since mechanical treatments would be limited in wilderness and fire would be the main restoration tool, this alternative would make less habitat restoration progress in those areas than other alternatives, including less forage availability for potential prey species,

Determination: While some individuals could be impacted by actions on the Cibola, the alternative management activities would not adversely affect the viability of the species. Overall, species viability would be maintained. Beneficial impacts include improvements in connectivity by decreasing the amount of roads and modest increases in forage for prey species.

Chiricahua Leopard Frog, Alamosa Springsnail, Yellow-Billed Cuckoo, Southwestern Willow Flycatcher and Zuni Bluehead Sucker

Species that depend on riparian or wetland habitat and either constructed or natural waters would realize a modest improvement in habitat. Effects would be similar to alternative B with slight to moderate improvements to watershed (fire regime condition class) condition class. Roads and range improvements would occur at the same rate as A but less than C. Water resource improvement projects would occur at the same rate as alternative C. There would be more designated wilderness under this alternative and habitat improvement projects would be limited in their ability to use mechanical equipment which could limit overall habitat improvement projects for riparian species in those areas.

Determination: Based on the analysis of plan components and the amount of habitat provided for each of the above species, viability would be maintained for all species under alternative D.

Zuni Fleabane

In addition to the plan components described under all action alternatives, the plan components (see above) for the management areas, conservation areas and restoration areas, would further maintain species viability by promoting resilient habitat, natural fire regime, and balancing the needs to maintain a viable population.

Determination: Based on the analysis of plan components and expected improvement of pinyon juniper and possibly soil condition class overall, species viability would be maintained. Beneficial impacts include a slight to moderate improvement in potentially suitable habitat.

Sensitive Species

Desired conditions, standards, and guidelines for federally listed species were analyzed under all action alternatives. The following analysis account for differences in plan objectives and proposed wilderness

Forested and Fire-Adapted Ecosystems (Ponderosa Pine Forest and Dry Mixed Conifer Vegetation Types, MCW, SFF)

Based on VDDT modeling, the following shows the change in frequent fire habitat conditions in 15 years:

Ponderosa Pine Forest

- Goshawk habitat would increase from 10 percent to 23 percent (44,272 to 105,967 acres).
- Allen's lapped-browed bat habitat, Arizona myotis habitat, and bald eagle habitat would in increase from 38 percent to 46 percent (173,088 to 210,977 acres)

Dry Mixed Conifer

- Goshawk habitat would increase from 10 to 26 (16,319 to 40,315 acres).
- Allen's lapped-browed bat habitat would increase from 32 to 46 (50,630 to 72,642 acres).

Overall habitat for goshawk would increase from 60,591 acres to 146,282 acres. Overall habitat for bald eagle and Arizona myotis would increase from 173,088 acres to 210,977 acres and overall habitat for Allen's lappet browed bat would increase from 223,718 acres to 283,619 acres.

Under alternative D, more optimal habitat would be restored for goshawk than alternatives A and B, but less than alternative C. Bald eagle, Arizona myotis, and Allen's lapped browed bat would realize less optimal habitat under alternative D than under A and B but more than alternative C.

Table 102. Current and projected sensitive species habitat in fire-adapted ecosystems, alternative D

Vegetation Type	Species	Current	In 15 Years	Percent Change
PPO	Goshawk	44,272	105,967	+13
DMC	Goshawk	16,319	40,315	+16
Total	NA	60,591	146,282	+29
PPO	Allen's lapped-browed bat habitat, Arizona myotis habitat, bald eagle habitat	173,088	210,977	+8
DMC	Allen's lapped-browed bat	50,630	72,642	+14
Total for Allen's lapped-browed bat	NA	223,718	283,619	+22

PPO = ponderosa pine/Gambel oak, DMC = dry mixed conifer

Determination: Based on the analysis of plan components and the amount of habitat provided for each of the above species, viability would be maintained for each of these species dependent on Ponderosa Pine Forest or Dry Mixed Conifer vegetation types under alternative D. While individual animals could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species.

Villous groundcover milkvetch and Sandia Mountain alumroot: The management areas under this alternative that have plan components are expected to improve habitat for villous groundcover milkvetch and Sandia Mountain alumroot, particularly the management areas within ponderosa pine and mixed conifer. The overall habitat for villous groundcover milkvetch and Sandia Mountain alumroot is expected to increase. Soil condition is expected to improve in 2 to 5 project areas annually in priority watershed areas and on 10,000 acres annually of vegetation projects in ponderosa pine forest and dry mixed conifer (see "Soils" section).

Determination: Based on the analysis of plan components and the amount of habitat provided for each of the above species, viability would be maintained for each of these species dependent on Ponderosa Pine Forest or Dry Mixed Conifer vegetation types under alternative D. While individual plants could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species. Beneficial effects include improvements in soils is expected which could improve the overall health to each species.

Riparian and Aquatic Associated Species (Includes Riparian Vegetation Types and Constructed and Natural Waters)

- Bald eagle
- Dumont's fairy shrimp
- Northern leopard frog
- Allen's lappet browed bat,
- Spotted bat
- Pale Townsend's big-eared bat
- Rio Grande chub
- Rio Grande sucker

Sensitive species that depend on riparian or wetland habitat and either constructed or natural waters would realize a modest improvement in habitat. Effects would be similar to alternative B, with slight to moderate improvements to watershed (fire regime condition class) condition class. This improvement would be more than alternative A but less than C.

Determination for southwestern willow-flycatcher, yellow-billed cuckoo, and Zuni bluehead sucker: Based on the analysis of plan components and the amount of habitat provided for each of the above species, viability would be maintained for each of these species dependent on riparian and aquatic habitat under alternative D. While some individuals could be impacted by actions on the Cibola, the alternative management activities would not adversely affect the viability of the species. Beneficial impacts include a slight improvement in potentially suitable habitat in riparian or aquatic systems resulting from improved hydrology. The lowered risk from uncharacteristic wildfire would also decrease negative effects from associated sedimentation and ash discharge which can occur as a result of this these types of events.

Determination for Alamosa springsnail and Chiricahua leopard frog: There could be some short-term localized adverse impacts to the Alamosa springsnail and the Chiricahua leopard frog and its critical habitat, but overall, species viability would be maintained. There would be a slight improvement in riparian and spring habitat quality for these species in the long term.

Nonforest-Dependent Species (Grasslands, Shrubland, Pinyon Juniper Vegetation Types).

Special Habitat Features (Cliffs and Rocky Features, Soils/Burrows)

- Pale Townsend's big-eared bat
- Spotted bat
- Gray vireo
- American peregrine falcon
- Burrowing owl
- Gunnison's prairie dog

Fuelwood offerings would remain the same as alternative A and B so the effects to species that use pinyon-juniper woodland would be the same. This alternative proposes the least amount of treatments; therefore the positive effects from livestock management and grazing including improvement in herbaceous conditions and forage would be greater than alternative A but less than alternative B and C. Effects from range improvement projects would be the same as alternative A.

Determination: Based on the analysis of plan components and the amount of habitat provided for each of the above species, viability would be maintained for each of these species dependent on grasslands, shrubland, and pinyon-juniper habitat under alternative D. While individual animals could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species.

Zuni milkvetch and Sivinski's fleabane: The management areas under this alternative that have plan components are expected to improve habitat for Zuni milkvetch and Sivinski's fleabane, particularly the management areas within Colorado Plateau/Great Basin, and pinyon-juniper. Fuelwood would be offered at the same rate as alternatives A and D, and effects on Zuni milkvetch and Sivinski's fleabane would be the same. Livestock distribution would increase slightly under this alternative, improving herbaceous vegetative conditions. This would lead to increased plant cover and improved soil conditions.

Determination: Based on the analysis of plan components and the amount of habitat provided for each of the above species, viability would be maintained for each of species dependent on Colorado Plateau/Great Basin and pinyon-juniper habitat. While individual plants could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species.

Abiotic and Rocky Features

Rocky Mountain bighorn sheep, American peregrine falcon, pale Townsend's big-eared bat, Arizona myotis, and Mexican spotted owl.

Effects to species that use abiotic and rocky feature are described under all action alternatives. There would be no changes in habitat quantity or quality between alternatives.

At Risk Species-Species of Conservation Concern

Effects to at-risk species from desired conditions, standards, and guidelines are described under all action alternatives. The primary difference between alternatives is for objectives and the amount of habitat restored for fire-adapted ecosystems and riparian improvements, and the amount of habitat designated as wilderness (the most of any alternative). Threats to at-risk species can also be found under all action alternatives.

Forested and Fire-Adapted Ecosystems (Ponderosa Pine Forest and Dry Mixed Conifer Vegetation Types: DMC, PPF, SFF, MCW, MPO)

Mexican spotted owl, northern goshawk, red-faced warbler, Graces' warbler, Arizona myotis, American peregrine falcon, Lewis's woodpecker*

Species that use forested and fire adapted ecosystems would benefit from objectives realized through the vegetation and fire management program areas. Under this alternative, departure from desired conditions for ponderosa pine and dry mixed conifer would be similar to alternative B. This would be an improvement from current conditions but not as good as alternative C. Overall habitat for the majority of species of conservation concern that use both ponderosa pine and dry mixed conifer would increase from 60,591 acres to 146,282 acres. Overall habitat for Arizona myotis would increase from 173,088 acres to 210,977 acres (ponderosa pine only).

Under alternative D, more optimal habitat would be restored for species of conservation concern that use fire adapted ecosystems than alternatives A and B, but less than alternative C. Arizona myotis would realize less optimal habitat under alternative D than under A and B but more than alternative C (table 92 and figure 17).

Tree Features including Large Trees, Cavities, Snags, Leaves, Bark, Downed Logs, Leaf, or Forest Litter (PPF, DMC, SFF, MCW, MPO, MMS, PJG, PJO, Riparian):

Mexican spotted owl, Lewis's woodpecker, northern goshawk, red-faced warbler, Graces' warbler, juniper titmouse, gray vireo*

Effects to at-risk species that use tree features would be similar to forested and fire-adapted ecosystems as described above. Species that also use also use riparian systems (Mexican spotted owl, Arizona myotis, red faced warbler, Lewis's woodpecker) would benefit from objectives to improve water resource features. Effects would be similar to alternative B, with slight to moderate improvements to watershed (fire regime condition class) condition class. This improvement would be more than alternative A but less than C. Fuelwood offerings would remain the same as alternative A and B, so the effects to species that use pinyon-juniper woodland would be the same.

Riparian or Aquatic Systems (Riparian Habitat, Seeps/Springs, Wetlands, Stock Tanks/Drinkers)

Arizona myotis, Dumont's fairy shrimp, red-faced warbler, Lewis's woodpecker, Mexican spotted owl. southwestern willow flycatcher,* western yellow-billed cuckoo,*Alamosa springsnail,* Chiricahua leopard frog,* northern leopard frog, Rocky mountain bighorn sheep, Zuni bluehead sucker*, Rio Grande chub, and Rio Grande sucker*

Species of conservation concern that depend on riparian or wetland habitat and either constructed or natural waters would realize a modest improvement in habitat. Effects would be similar to alternative B, with slight to moderate improvements to watershed (fire regime condition class) condition class. Objectives would move ecological conditions toward the desired state.

Nonforested Vegetation (PJO, JUG, MSG, CPGB, SDG, CDS, SAGE, MMS)

Aplomado falcon, Gunnison's prairie dog, burrowing owl, Rocky Mountain bighorn sheep, gray vireo, loggerhead shrike, Bendire's thrasher, juniper titmouse, *Zuni fleabane, Zuni milkvetch, and Sivinski's fleabane.*

This alternative proposes the least amount of vegetation treatments; therefore, the positive effects from livestock management and grazing would be greater than alternative A but less than alternative B and C. Effects from range improvement projects would be the same as alternative A. There are no objectives for the other nonforested vegetation types and the effects to species that use those systems are described under the all action alternatives section. There would be no changes in habitat quantity or quality between alternatives.

Abiotic and Rocky Features

Rocky Mountain bighorn sheep, American peregrine falcon, pale Townsend's big-eared bat, Arizona myotis, and Mexican spotted owl.

Effects to species that use abiotic and rocky feature are described under all action alternatives. There would be no changes in habitat quantity or quality between alternatives.

Summary of All Alternatives

Fire-adapted and riparian ecosystems are all highly departed from reference conditions. All alternatives would move ecological conditions for wildlife to a more desired state than that which currently exists. For the action alternatives, plan components addressing threats or risks to species are displayed in volume 2, appendices E and F. All alternatives would maintain viability for listed and sensitive species and persistence for at-risk species (within the authority of the Forest Service); however, the rate and magnitude of change to wildlife habitat varies (table 91, table 92, figure 16, and figure 17; also see the "Vegetation" section). It was not possible to quantify all habitat changes for all species. For example, for species that use nonforested and riparian or aquatic systems, qualitative conclusion were made based on expected habitat improvement projects.

Alternative A is limited in terms of its ability to positively affect species viability because it lacks clear desired conditions and guidelines developed using the best available science; it does not reflect the most current advances in scientific understanding and changes in social, economic and ecological conditions that have occurred since it was signed; and it is the least able to adapt to changing conditions. Alternative A also lacks forestwide language that directly addresses the significant threats of disease and invasive, nonnative animals, connectivity and restricted and endemic species that are naturally rare. Plan components for at-risk species were not developed using a complementary ecosystem and specific-specific approach. Overall this alternative would realize the least amount of restoration progress for the most wildlife species than the other alternatives. At a minimum, species viability will be maintained but ecosystem recovery will be on a slower trajectory than for the action alternatives for most species.

Alternative C focuses on restoration and sets ecosystems on a faster trajectory toward achieving desired conditions within the 10- to 15-year life of the plan compared to the other alternatives. Alternative C provides for the greatest number of infrastructure and sustainable grazing and range projects which will have beneficial effects on aquatic and riparian habitats. Alternative C sets the best conditions to allow species to adapt to climate change because it includes specific guidance that provides for better ecological integrity and moves the vegetation types that at-risk species depend on toward the desired state in the least amount of time. It improves habitat quality and distribution at the fastest rate and magnitude for the greatest number of species than the other alternatives. A caveat to this is that because fuel reductions under this alternative focus more heavily on infrastructure improvement in the wildland-urban interface, less progress would be made under this alternative in terms of improving nest and roost habitat for the Mexican spotted owl than under alternative A. However, nest and roost habitat would still increase from current conditions. Further, this alternative has more clearly defined plan components than alternative A to more effectively address wildlife species needs at multiple spatial scales. Under this alternative, species are generally protected through specific vegetation types and management area direction, however, in some cases there is additional species specific direction that provides even more emphasis and protection for at-risk species. Alternative C was specifically developed using both ecosystem-level and species-specific plan components (where needed). Alternative C also includes restoration and conservation management areas which should help focus and prioritize work over the life of the plan without being overly site specific. Alternative C also makes the most use of partnerships to implement work on the ground. Through this shared stewardship approach, the forest would move the landscape toward desired conditions at a faster rate than the other alternatives.

Alternatives B and D have similar effects for riparian species and would move habitat for the majority species towards desired conditions faster than alternative A. However, for some fire-adapted species alternative A would be slightly better, but plan components under alternative A would not be as a good as alternatives B and D in terms of providing for species viability. Both alternatives would include the same forestwide plan components for at-risk species as alternative C.

Alternative B and D recommends more new wilderness than alternatives A and C which would benefit some species in the short-term by reducing disturbance and allowing fire to play its natural role in the system. However, Cibola personnel would be limited to managed wildfires as a restoration tool in these areas. As a result, the net positive impacts from these additions on some species could be counterbalanced by the potentially negative adverse effects that could result from uncharacteristic stand-replacing wildfire. In addition, alternative B has ten site-specific management areas. This could limit the ability of Cibola personnel to respond to changing conditions and emerging needs over time. Alternatives B and D better provide for overall species viability than alternative A; however, not as well as alternative C for the majority of species.

Cumulative Environmental Consequences

The land management plan is a management framework on how to proceed. It does not authorize a project. Any specific project or action will have appropriate level of environmental analysis completed including project minimization measures to provide protection to wildlife and fish species. All past actions in the plan area have contributed to the existing baseline. Therefore only future actions would be considered. Future actions will be addressed in the specific project-level environmental analysis. Ongoing, landscape-level projects occurring in the area include the Zuni Mountains Collaborative Forest Restoration Project which aims to enhance structural complexity and improve fire behavior. In addition, the Bureau of Land Management has developed five resource management plans to manage lands adjacent to the Cibola National Forest.

All species can be affected by management activities authorized under the 1985 plan, especially those pertaining to timber, vegetation, rangeland, fire management, and watershed protection and improvement. Risk was not assessed for vegetation types or other habitat factors on lands of other ownership; therefore, it is not possible to state with certainty the overall risk to the species at that scale. However, for some of these species, habitat provided on the Cibola represents the majority or in some cases, the only habitat available. Changing land use patterns, habitat degradation and loss, or simply the lack of suitable habitat off the Cibola place a particular emphasis on Cibola National Forest personnel to maintain these species.

To compare the effects of Cibola National Forest proposed management to the surrounding landscape, cumulative effects are evaluated considering the management actions of other entities of a similar planning scope within a relevant spatial and temporal context. The analysis area for wildlife, fish, and plants includes the Cibola and relevant portions of New Mexico Game and Fish managed lands and Bird Conservation Regions 16 (Southern Rockies/Colorado Plateau), 34 (Sierra Madre Occidental), and 35 (Chihuahuan Desert). This encompasses the counties immediately adjacent to or surrounding the Cibola National Forest and is of a spatial extent that should account for effects on wide-ranging species such as big game and migratory birds—animals that can travel across numerous land jurisdictions. The analysis area encompasses similar habitat types as identified in the proposed action area and reflects similar ecological settings which species referenced in this report could or would use. These effects were evaluated for the life of the land management plan, approximately 10 to 15 years.

Departures from reference conditions exist in all forested vegetation types on the Cibola National Forest, and most continue to trend further from reference conditions (moderate to high departure). Grassland and shrubland systems are low to moderately departed. These trends are also common on adjacent lands. The landscape has become more fragmented as a result of activities that include urban development, ranching, and fire suppression. As a result, there has likely been a net loss of intact, potential habitat and an increased risk to viability for species on adjacent lands; this trend is expected to continue in the future. As a result, the Cibola will play an increasing role in the conservation of these habitats and associated species on National Forest System lands. The sky islands act as an oasis for wildlife habitat amidst a heavily populated urban setting.

Timber harvest, fire suppression, thinning, planting, and wildfires are the past activities that have had the greatest influence on the amount and distribution of forested habitat on National Forest System lands as well as Bureau of Land Management, State, and private timber lands. These activities have created a variety of successional stages, structures, tree species mixes, and forest patterns that have been neutral for some species, beneficial to some species, and detrimental to others. The action alternatives strive to create and maintain natural communities and habitats in the amounts, arrangements, and conditions capable of supporting viable populations of existing species within the planning area, while contributing to broader landscape-scale initiatives where appropriate. As such, species are distributed throughout their natural potential range. The adaptive management process and collaborative efforts with partners should also help to inform and realize these conditions on the ground.

Habitat Restoration

Under the action alternatives, prescribed fires and mechanical thinning would continue across the Cibola (and adjacent lands) in the coming years to reduce accumulated fuels that can cause uncharacteristic wildfire. Cumulatively, these actions are expected to improve habitat while decreasing the overall long-term viability risk to wildlife species that evolved with fire-adapted ecosystems.

These goals and strategies are consistent with and complementary to strategies identified in New Mexico Bird Conservation Plan 2.1 (New Mexico Partners in Flight 2007). This plan emphasizes sustainability, a return to historic (reference) conditions and is based on the principles of best science, best management practices, and an adaptive management process that includes measurable goals, objectives, strategies, and approaches.

The Intermountain West Joint Venture Implementation Plan (IWJV 2013), which provides overall direction for managing migratory land birds, shorebirds, and waterfowl in bird conservation regions 16, 34, and 35, emphasizes protection of key habitats for birds and outline goals and objectives for inventory and monitoring, research, information and education, management, and issues involving Neotropical migratory bird species. The Federal recovery plans for the Mexican spotted owl (U.S. Fish and Wildlife Service 2012b) further guides activities for that species.

Mechanical thinning and fire can affect wildlife habitat in various ways. Projects are mitigated on a site-specific basis to reduce negative effects that might result from habitat modification. Collectively, projects can affect foraging, nesting, hiding, and thermal cover, and potentially daily movements on a short-term basis, but most wildlife species would benefit over the long term. Much of the forests and woodlands in the Southwest has become denser than under historic (presettlement conditions) because of decreased wildfire frequency (Swetnam et al. 1999, Covington and Moore 1994, Covington 2003). Cibola National Forest restoration activities identified in the preferred alternative are likely to move habitat structure and composition back to conditions more consistent with conditions that occurred during the recent evolutionary past for wildlife species on the Cibola and adjacent lands.

Because wildlife species are subject to movement (frequently over great distances), efforts on adjacent lands are important considerations in this process. Continuity is important and projects which span land management jurisdictions will likely be most effective in providing adequate habitat distribution for wildlife over time, further minimizing viability risk. This requires collaboration among various organizations and stakeholder groups.

Similar land management planning efforts are underway on two neighboring national forests: the Carson and Santa Fe. Both are also revising their land management concurrently with the Cibola, and efforts were made to foster cross-plan consistency where possible during plan development. The plans are based upon the same regional vegetation desired conditions, standards, and guidelines and similar objectives for ponderosa pine and mixed conifer. The cumulative restoration activities from the action alternatives from these plans could have a pronounced effect on modifying stand structure to be less susceptible to stand-replacing fire in these vegetation types, while promoting resiliency with regard to climate change. Collectively, the net result of these revised land management plans should be positive and beneficial for wildlife species by ensuring the persistence of these habitats into the future and by providing continuity of suitable habitats. This should decrease the overall risk to species viability.

Development and Connectivity

Some wildlife species are especially at risk with regard to development. For example, birds, bats, and wide-ranging species can be affected by transmission lines, turbines, roads, and other activities associated with renewable energy endeavors. These types of activities, which occur on lands of different ownerships and jurisdictions, are anticipated to increase in the future. U.S. Fish and Wildlife Service personnel have issued interim guidelines for site-specific development of wind energy facilities that may affect wildlife (U.S. Fish and Wildlife Service 2012d). On the Cibola, proposals for development would be dealt with on a case-by-case basis through special uses and the permitting process.

Existing collaborations between Cibola National Forest personnel and partners generally encourage the protection of open lands and the preservation of the land's natural character within local and regional contexts. Cumulatively, these strategies should decrease the potential for future land fragmentation, while improving the overall integrity of the landscape. This should also provide for more resilience with regard to climate change for those wildlife species that may need to adjust migration routes, foraging corridors, or breeding grounds.

Riparian systems have decreased in size over the past 100 years, largely a result of human development. Riparian communities are highly departed from reference conditions, comprising only 0.5 percent of the Cibola National Forest. Historically, annual flooding was a major disturbance needed to maintain the historic vegetation levels necessary for many wildlife species which utilize this habitat type. This community is currently departed from historic conditions due to upstream diversions, impoundments, and tamarisk invasion. The Rio Grande watershed is not wholly contained within the Cibola, and Cibola National Forest personnel have little control over off-forest water management. For this reason, it will be difficult for the forest to fully restore this habitat to reference conditions. Water resource management activities, including maintaining perennial water quality, quantity, and timing of flows contribute a very important role in overall ecological function and sustainability of these watersheds and riparian habitat.

Most of these activities are regulated outside the boundary of the Cibola. Although Cibola personnel manage what they can in terms of riparian health, cumulatively when combined with management activities of other jurisdictions, these actions would not likely be sufficient to maintain the ecological integrity of riparian habitat over time. For this reason, it will be difficult for Cibola personnel to fully restore this habitat to reference conditions. As a result, riparian-dependent species such as the yellow-billed cuckoo, southwestern willow flycatcher, Alamosa springsnail, and Chiricahua leopard frog, which could use this type of habitat, would not realize its full potential. Detailed information on natural flooding regimes and water use can be found in the "Water Resources" section of this document and volume 1 of the assessment.

Climate Change

In general, most climate modelers agree that the Southwest is trending toward prolonged drought. Future potential ecological effects in the Southwest may include an increase in more intense disturbance events such as wildfires, monsoons, and wind. Changing ecological conditions could provide greater opportunities for invasion by nonnative species and disease with the potential to negatively impact various taxa. General trends toward decreased precipitation could limit overall forest productivity and associated changes in vegetation patterns could affect overall distribution and range of plant and animal species. Cumulatively these factors would likely impact biodiversity; however, the extent is currently uncertain (Periman 2008, Periman et al. 2009 and references therein).

Summary

In summary, these cumulative effects, when combined with the preferred alternative, are expected to be beneficial for fish, plants, and wildlife by providing more collaborative opportunities through partnerships and better coordination across the landscape. This should move departed habitat conditions toward the desired state a faster rate and magnitude than the other alternatives. Alternatives B and D would have similarly positive effects but would have less overall partnership opportunities than alternative C and would make slower progress. Alternative A (no action) would make the least contribution toward cumulative benefits for wildlife, fish, and plants.

Other Required Disclosures

Unavoidable Adverse Effects

The draft land management plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carry out any project or activity. Therefore, decisions made in the land management plan do not cause, or have the potential to result in, actual irreversible or irretrievable commitment of resources (see next section). Application of the land management plan standards and guidelines during future project and activity decision making would provide resource protection measures and limit the extent and duration of any adverse environmental impacts. For a detailed discussion of types of consequences expected from future activities, see specific resource areas in this chapter.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line right-of-way or road.

The draft land management plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carry out any project or activity. Because the draft land management plan does not authorize or mandate any site-specific project or activity (including ground-disturbing actions), none of the alternatives cause an irreversible or irretrievable commitment of resources.

Short-term Uses and Long-term Productivity

The National Environmental Policy Act (NEPA) requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by Congress, this includes using "all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans" (National Environmental Policy Act, section 101). Short-term uses are those that generally occur for a finite time period. Long-term productivity refers to the ability of the land to produce a continuous supply of a resource.

The change in the programmatic management of the Cibola National Forest under alternatives B, C, or D would not jeopardize the short-term or long-term productivity of the lands and resources of the Cibola. Discussion of short- and long-term effects is included in the analysis of the environmental consequence for each resource area in this chapter.

Laws Requiring Consultation

The regulations for implementing the National Environmental Policy Act at 40 CFR 1502.25(a) direct "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with . . . other environmental review laws and executive orders." As a proposed Federal project, the revised plan decisions are subject to compliance with other Federal and State laws. Determinations and decisions made in the draft land management plan have been evaluated in the context of relevant laws and executive orders. Throughout the development of the revised plan, there has been collaboration with various State and Federal agencies. The following actions have been taken to document and ensure compliance with laws that require consultation, concurrence, or both with other Federal agencies.

- Endangered Species Act, Section 7: Consultation with the U.S. Fish and Wildlife Service, regarding federally listed threatened, endangered, and proposed species, and designated and proposed critical habitat is in progress. A biological assessment for federally listed species will be prepared and submitted to the U.S. Fish and Wildlife Service for consultation according to the Endangered Species Act. At this time the biological assessment has been drafted, and a consultation agreement has been initiated with the U.S. Fish and Wildlife Service.

- National Historic Preservation Act: Consultation with the New Mexico State Historic Preservation Officer is mandated by section 106 of the National Historic Preservation Act. The First Amended Programmatic Agreement Regarding Historic Property Protection and Responsibilities among the New Mexico State Historic Preservation Officer, and the Arizona State Historic Preservation Officer, and the Texas State Historic Preservation Officer, and the Oklahoma State Historic Preservation Officer, and the Advisory Council on Historic Preservation, and United States Department of Agriculture, Forest Service Region 3 was executed in December 2003. This programmatic agreement prescribes the manner in which region 3 and the State historic preservation officer shall cooperatively implement this programmatic agreement in New Mexico, Arizona, and portions of Texas and Oklahoma. It is intended to ensure that Region 3 organizes its programs to operate efficiently and effectively in accordance with the intent and requirements of the National Historic Preservation Act and that Region 53 integrates its historic preservation planning and management decisions with other policy and program requirements. The programmatic agreement streamlines the National Historic Preservation Act section 106 process by eliminating case-by-case consultation with the State historic preservation officer on undertakings for which there is no or little potential to affect historic properties and for undertakings that either culminate in no historic properties affected or no historic properties adversely affected with approved standard protection measures (36 CFR 800.4(d)(1) and 800.5(d)(1).
- Government-to-government consultation was completed with American Indian Tribes who have aboriginal territory within the lands now part of the Cibola National Forest, as required by the National Historic Preservation Act; Executive Orders 13007 and 13175; and the programmatic agreement cited above. More information on this consultation can be found in the "Public Participation" section of chapter 1 and in the "Traditional Communities and Uses" section of chapter 3 of this document.

Chapter 4. Preparers, Consultation, and Coordination

Preparers and Contributors

The following individuals and Forest Service staff groups contributed to development of this environmental impact statement. A steering committee made key decisions through the plan revision process comprised of the forest supervisor of the Cibola National Forest; the timber and natural resources management officer; the recreation, engineering, archaeology, lands and minerals staff officer; the fire staff officer; and the four district rangers (Sandia, Mountainair, Magdalena and Mount Taylor). The responsible official is Steven Hattenbach, Forest Supervisor for the Cibola National Forest and National Grasslands.

Interdisciplinary Team Members

The interdisciplinary team is comprised of a core team and an extended team. While all interdisciplinary team members contributed to the development of the draft environmental impact statement (DEIS) and draft land management plan, the core team members, and primary authors are listed below and their major contributions are noted in parentheses in the "DEIS Contributions" column. The term "detail" indicates a formal or informal temporary work assignment to the interdisciplinary team.

Table 103. Core interdisciplinary team members

Name	Title	Highest Degree	DEIS Contribution	Years of FS Experience
Steven, Hattenbach	Forest supervisor	Juris doctorate from Indiana University-Bloomington	Management review	4
Elaine Kohrman	Southwestern Region deputy regional forester, former forest supervisor	Masters in whole systems design from Antioch University	Management review	32
Sarah Beck	Forest planner and environmental coordinator, Rocky Mountain Region, Arapaho and Roosevelt National Forests, forest planner fall 2016-January 2017, wildlife planner 2013 to 2016	Masters of science in natural resource management from Ohio State University	Management review, chapters 1 and 2	5
Sarah Browne	Forest planner	Masters in community regional planning, University of New Mexico School of Architecture and Planning	Management review, chapters 1 and 2, socioeconomics forest counterpart	4
Molly Cobbs	Forest planning service line manager, Enterprise Program		Enterprise land management plan support project manager	
Allison Borchers	Economist, enterprise program	PhD in economics from the University of Delaware	Socioeconomic	2.5

Name	Title	Highest Degree	DEIS Contribution	Years of FS Experience
Christy Prescott	Social scientist, Enterprise Program	Masters in environment and community from Humboldt State University	Socioeconomic	14
Michael Carpinelli	Forester	PhD in restoration ecology from Montana State University	Vegetation and timber suitability	13
Jessica Dunn	Recreation program manager, former designated areas and wilderness specialist	Masters in fine arts and landscape architecture from University of New Mexico, School of Architecture and Planning	Forest counterpart for designated areas, recreation and scenery	8
Jennifer Wright	Designated areas specialist, Enterprise Program	Master of Science in natural resources, ecological planning and ecological economics from University of Vermont	Designated areas	9
Elizabeth Sousa	Recreation specialist, Enterprise Program		Recreation	
Nicole Hill	Landscape architect, Enterprise Program	Bachelors of science in landscape design and environmental management	Scenery	15
Robin Price	Former special uses specialist			
Kathi Turner	Assistant forest archaeologist	Masters in archaeology from Washington State University	Cultural and historic resources	13
Jeremy Kulisheck	Forest archaeologist and heritage program manager	PhD in anthropology, 2005, Southern Methodist University	Forest counterpart cultural and historic resources	18
Robyn Morris	Archaeologist, Enterprise Program	Master's in anthropology from the University of Wyoming	Cultural and historic resources	13
Donald Serrano	Range program manager	Bachelors of science in agriculture Science from Wildlife Management and Range from New Mexico State University	Forest counterpart range	18
Troy Grooms			Range	
Diane Tafoya	Regional geologist	Bachelors of arts in geology from University of New Mexico	Minerals and geology	32

Name	Title	Highest Degree	DEIS Contribution	Years of FS Experience
Jennifer Gatlin	Wildlife program manager (detailed in position summer 2018)	Masters of science in zoology from Oklahoma State University	Forest counterpart terrestrial, aquatic, and botanical species	5
Valerie Stein Foster	Wildlife biologist, Enterprise Program	Masters of science in botany from the University of Hawaii at Manoa	Terrestrial, aquatic, and botanical species	10
Angela Gatto	Wildlife biologist, Enterprise Program	Masters of science in forestry from Northern Arizona University	Terrestrial, aquatic, and botanical species	16
Livia Crowley	Forest hydrologist	Bachelors of arts in geology from Hartwick University	Water resources and air	28
Rob Arlowe	Resource information program manager	Bachelors in natural resource management from Rochester University	GIS	17
Peggy O'Keefe	Forest engineer	Bachelors in biological and agricultural engineering from North Carolina State University	Forest counterpart infrastructure	12
Frank Yurczyk	Planning forester, Enterprise Program	Bachelors of science in forest management from University of Minnesota	Infrastructure	50
Daniel LeVier	Geographer	Bachelors of science in geography from University of New Mexico	GIS	8
Abie Carabajal	Fire ecologist	Masters of science in forestry from Northern Arizona University	Fuels and fire	17
Glen Lewis	Fuels and fire, Enterprise Program		Fuels and fire	

Table 104. Interdisciplinary team members: staff and line officers

Name	Title	Highest Degree	DEIS Contribution	Years of Experience
Alvin Whitehair	Mount Taylor district ranger	Bachelors in psychology and rangeland resources from Utah State University	Management areas	12
Kim Obele	Magdalena district ranger	Master of science in rangeland ecosystems from Colorado State University	Management areas	13
Jay Tuner	Mountainair district ranger	Masters in Anthropology from New Mexico State University	Management areas	17
Crystal Powell	Sandia district ranger	Bachelors of science in park and recreation management from Slippery Rock University of Pennsylvania	Management areas	18
Cynthia Benedict	Tribal relations liaison (retired)	Masters in anthropology from Texas Tech University	Traditional communities and uses	30
Donna Nemeth	Public Affairs Officer	Bachelor of arts in fine arts from University of Maine	Public relations	27
Matt Rau	Fire Staff Officer	Ecosystem management – natural resource from Utah State University	Forest counterpart fire and fuels	19

Consultation and Coordination

The Forest Service consulted with the following federally recognized tribes, land grants-*mercedes*; Federal, State, and local agencies; special interest groups; and individuals during development of this draft environmental impact statement.

Federally Recognized Tribes and Pueblos

Acoma Pueblo

Navajo Nation

Cochiti Pueblo

San Felipe Pueblo

Ft. Sill Apache Tribe

San Illdefonso Pueblo

Hopi Tribe

Sandia Pueblo

Isleta Pueblo

Santa Ana Pueblo

Jemez Pueblo

Santo Domingo

Laguna Pueblo

Zia Pueblo

Mescalero Apache Tribe

Zuni Pueblo

Jicarilla Apache

Land Grants-*Mercedes*

Canon de Carnue Land Grant-Merced

San Antonio de las Huertas Land Grant-Merced

Chilili Land Grant-Merced

Tajique Land Grant-Merced

Manzano Land Grant-Merced

Torreon Land Grant-Merced

Federal and State Agencies

Bureau of Land Management

New Mexico Game and Fish

Kirtland Air Force Base

New Mexico Land Grant Council

National Park Service-Salinas Pueblo

New Mexico State Forestry

New Mexico Department of Agriculture

New Mexico State Historic Preservation Office

New Mexico Environment Department

New Mexico State Lands Office

County and Local Government and Agencies

Torrance County

Cibola County

Bernalillo County

McKinley County

Lincoln County

Sierra County

Catron County

Chavez County

Hidalgo County Commission

Sandoval County-Fire Department

Socorro County

New Mexico Association of Conservation Districts

Edgewood Soil and Water Conservation District

Ciudad Soil and Water Conservation District

Claunch-Pinto Soil and Water Conservation District

Coronado Soil and Water Conservation District

Lava Soil and Water Conservation District

Salado Soil and Water Conservation District

McKinley Soil and Water Conservation District

Sierra Soil and Water Conservation District

Valencia Soil and Water Conservation District

East Torrance Soil and Water Conservation District

Quemado Soil and Water Conservation District

City of Albuquerque

City of Grants

City of Gallup

Village of Magdalena

New Mexico Tech

Village of Milan

Catron County Farm and Livestock Bureau

Nongovernmental Organizations and Others

The Wilderness Society

Great Old Broads for Wilderness

National Wildlife Federation

New Mexico Wildlife Federation

Albuquerque Wildlife Federation

New Mexico Wilderness Alliance

New Mexico Backcountry Hunters and Anglers

Cottonwood Gulch Foundation

New Mexico Sportsmen

Dona Ana County Associated Sportsmen

Wild Turkey Sportsmen Association

Southwest Consolidated Sportsmen

Hispanics Enjoying Camping and Hunting Outdoors

National Trust for Historic Preservation

New Mexico Archaeological Council

New Mexico Mountain Club

New Mexico Farm and Livestock Bureau

Audubon New Mexico Forest Task Force

Center for Biological Diversity

Sierra Club

Central New Mexico Audubon

Talking Talons

The Nature Conservancy

Cochise Bicycle Advocates

Forest Stewards Guild

Friends of Tijeras Pueblo

Geoarchaeological X-Ray Flourescence Spectrometry Laboratory

Audubon New Mexico

Native Plant Society of New Mexico

International Mountain Bicycling Association

New Mexico Off-Highway Vehicle Alliance

Jeeps West 4x4 Club

New Mexico Forest Industry Association

Langmuir Laboratory

Albuquerque Mountain Biking Association

Magdalena Astronomical Society

New Mexico Council of Outfitters & Guides

Estancia Basin Resource Association

Mountainair Allotment Owners Association

Backcountry Horsemen of New Mexico

Wildlife Conservation Advocacy Southwest

New Mexico Tech Bike Club

Rock Hill Ranch

San Juan Ranch Allotment

Sandia Soaring Association

Flying V Ranch

Land and Natural Resources Advisory Committee

New Mexico Federal Lands Council

New Mexico Wool Growers, Inc.

New Mexico Cattle Growers Association

Cooperating Agencies with Memoranda of Understanding

Acoma Pueblo

Magdalena Village

City of Albuquerque

Manzano Land Grant

Bernalillo County

McKinley County

Bureau of Land Management

McKinley Soil and Water Conservation District

Canon de Carnue Land Grant

National Park Service-Salinas Pueblo

Catron County

New Mexico Department of Agriculture

Chilili Land Grant

New Mexico Environment Department

Cibola County

New Mexico Game and Fish

Ciudad Soil and Water Conservation District

New Mexico Land Grant Council

Claunch Pinto Soil and Water Conservation District

New Mexico State Historic Preservation Office

Pueblo de Cochiti

Salado Soil and Water Conservation District

Coronado Soil and Water Conservation District

San Antonio de las Huertas Land Grant

East Torrance Soil and Water Conservation District

Pueblo of San Felipe

Edgewood Soil and Water Conservation District

Sandoval County

City of Gallup

Pueblo of Santa Ana

City of Grants

Sierra County

Pueblo of Isleta

Sierra Soil and Water Conservation District

Kirtland Air Force Base

Socorro County

Pueblo of Laguna

Tajique Land Grant

Lava Soil and Water Conservation District

Torrance County

Lincoln County

Torreon Land Grant

Valencia Soil and Water Conservation District

Distribution of the Environmental Impact Statement

At the time of formal release for this draft environmental impact statement, it has been distributed to, or made electronically available to, individuals and groups who specifically requested a copy of the document or commented during public involvement opportunities. In addition, copies were sent (or in some cases made electronically available) to Federal agencies, federally recognized tribes, State and local governments, and organizations that have requested to be involved in the development of this analysis. The distribution list is available on the Cibola's plan revision website at http://www.fs.usda.gov/goto/cibola/plan

Glossary

Acequia or community ditch: A historical community ditch in New Mexico that carries snow runoff, spring flows, or river water to irrigate fields and is administered by a governing board.

Adaptation: Adjustment in natural or human systems to a new or changing environment. Adaptation includes, but is not limited to, maintaining primary productivity and basic ecological functions, such as energy flow; nutrient cycling and retention; soil development and retention; predation and herbivory; and natural disturbances. Adaptation occurs primarily by organisms altering their interactions with the physical environment and other organisms.

Adaptive capacity: The ability of ecosystems to respond, cope, or adapt to disturbances and stressors, including environmental change, to maintain options for future generations. As applied to ecological systems, adaptive capacity is determined by:

1. Genetic diversity within species in ecosystems, allowing for selection of individuals with traits adapted to changing environmental conditions.
2. Biodiversity within the ecosystem, both in terms of species richness and relative abundance, which contributes to functional redundancies.
3. The heterogeneity and integrity of ecosystems occurring as mosaics within broader-scaled landscapes or biomes, making it more likely that some areas will escape disturbance and serve as source areas for recolonization.

Adaptive management: Adaptive management is the general framework encompassing the three phases of planning: assessment, plan development, and monitoring (36 CFR 219.5). This framework supports decision-making that meets management objectives while simultaneously accruing information to improve future management by adjusting the plan or plan implementation. Adaptive management is a structured, cyclical process for planning and decision-making in the face of uncertainty and changing conditions with feedback from monitoring, which includes using the planning process to actively test assumptions, track relevant conditions over time, and measure management effectiveness.

Airshed: A geographic area that, because of topography, meteorology, and/or climate is frequently affected by the same air mass.

Assessment: For the purposes of the land management planning regulation at 36 CFR part 219 and this Handbook, an assessment is the identification and evaluation of existing information to support land management planning. Assessments are not decision-making documents, but provide current information on select topics relevant to the plan area, in the context of the broader landscape (36 CFR 219.19).

At-risk species: A term used in land management planning and this Handbook to refer to, collectively, the federally recognized threatened, endangered, proposed, and candidate species and species of conservation concern within a plan area.

Authorized livestock numbers: Year-to-year actual stocking of livestock on a grazing allotment, based on forage and water availability, condition of range improvements, climatic conditions, personal convenience for the permittee, or resource protection. Authorized numbers are not necessarily the number on the permit.

Basal area: The cross-sectional area at breast height (4.5 feet above the ground) of trees measured in square feet. Basal area is a way to measure how much of a site is occupied by trees. The cross-sectional area is determined by calculating the tree's radius from its diameter (diameter/2 = radius) and using the formula for the area of a circle (π x radius2 = cross-sectional area). Basal area per acre is the summation of the cross-sectional area of all trees in an acre or in a smaller plot used to estimate basal area per acre. Diameter at root collar (defined below) is used to calculate the cross-sectional area of multi-stemmed trees such as juniper and oak.

Base area: The main area at the bottom of a winter or summer resort.

Best management practices: Methods, measures, or practices selected by an agency to meet its nonpoint source control needs. Best management practices include but are not limited to structural and nonstructural controls and operation and maintenance procedures. Best management practices can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (36 CFR 219.19).

Biological soil crusts: Crusts of soil particles formed by living organisms (such as algae, mosses, lichens) in arid areas. They hold soil in place, help retain moisture, and improve soil nutrients by fixing atmospheric nitrogen.

Broader landscape: For land management planning pursuant to 36 CFR 219, the plan area and the lands surrounding the plan area. The spatial scale of the broader landscape varies depending upon the social, economic, and ecological issues under consideration.

Candidate species: For species under the purview of the U.S. Fish and Wildlife Service, a species for which the U.S. Fish and Wildlife Service possesses sufficient information on vulnerability and threats to support a proposal to list as endangered or threatened, but for which no proposed rule has yet been published by the U.S. Fish and Wildlife Service personnel. (36 CFR 219.19)

For species under the purview of the National Marine Fisheries Service, a species that is:

1. The subject of a petition to list as a threatened or endangered species and for which the National Marine Fisheries Service has determined that listing may be warranted, pursuant to section 4(b)(3)(A) of the Endangered Species Act (16 U.S.C. 1533(b)(3)(A)), or
2. Not the subject of a petition but for which the National Marine Fisheries Service has announced in the Federal Register the initiation of a status review.

Chaining: Uprooting of trees and shrubs to create a seedbed by pulling a chain behind two tractors traveling parallel to each other.

Climate change: A change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.

Climate variability: Refers to shorter term (daily, seasonal, annual, inter-annual, several years) variations in climate, including the fluctuations associated with El Niño (wet) or La Niña (dry) events.

Climax condition (seral stages): The stage where an ecosystem has reached a steady state. Through the process of ecological succession, an equilibrium is reached in which the biological community is best adapted to the average conditions in that area.

Coarse woody debris: Fallen dead trees and the remains of large branches on the ground in forests and in rivers or wetlands.

Collaboration or collaborative process: A structured manner in which a collection of people with diverse interests share knowledge, ideas, and resources, while working together in an inclusive and cooperative manner toward a common purpose. Collaboration, in the context of the land management planning regulation at 36 CFR part 219 and this Handbook, falls within the full spectrum of public engagement described in the Council on Environmental Quality's publication of October, 2007: Collaboration in NEPA— A Handbook for NEPA Practitioners (36 CFR 219.19).

Community wildfire protection plan: A comprehensive community based planning and prioritization approach for protection of life, property, and critical infrastructure in the wildland-urban interface. Protection plans may take a variety of forms based on the needs of the community, but must be collaboratively developed, identify and prioritize areas for hazardous fuel reduction treatments, recommend treatment types and methods, and recommend measures that homeowners and communities can take to reduce the ignitability of structures. The planning process may also identify management options and implications in the surrounding landscape. The Healthy Forests Restoration Act (HFRA) of 2003 instructed the US Forest Service to give consideration of community priorities as outlined in a community wildfire protection plan during planning and implementation of hazardous fuel reduction projects.

Connectivity: Ecological conditions that exist at several spatial and temporal scales that provide landscape linkages that permit the exchange of flow, sediments, and nutrients; the daily and seasonal movements of animals within home ranges; the dispersal and genetic interchange between populations; and the long distance range shifts of species, such as in response to climate change (36 CFR 219.19).

Conservation: The protection, preservation, management, or restoration of natural environments, ecological communities, and species (36 CFR 219.19).

Conserve: For the purpose of meeting the requirements of 36 CFR 219.9, to protect, preserve, manage, or restore natural environments and ecological communities to potentially avoid federally listing of proposed and candidate species (36 CFR 219.19).

Critical habitat: For a threatened or endangered species, (1) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of the Endangered Species Act (16 U.S.C. 1533), on which are found those physical or biological features (a) essential to the conservation of the species, and (b) which may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of the Endangered Species Act (16 U.S.C. 1533), upon a determination by the Secretary that such areas are essential for the conservation of the species. Endangered Species Act, section 3 (5)(A), (16 U.S.C. 1532 (3)(5)(A)). Critical habitat is designated through rulemaking by the Secretary of the Interior or Commerce. Endangered Species Act, section 4 (a)(3) and (b)(2) (16 U.S.C. 1533 (a)(3) and (b)(2)).

Cultural resources: The remains of sites, structures, or objects used by humans in the past, historic or prehistoric. More recently referred to as heritage resources.

Cumulative effects or impacts: The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor, but collectively significant actions, taken place over a period of time.

Decision document: A record of decision, decision notice, or decision memo (36 CFR 220.3).

Decommission: Treated in such a manner so as to no longer function as intended. Usually in reference to decommissioning of a road so that it no longer is apparent on the landscape.

Defensible space: An area either natural or manmade where material capable of allowing a fire to spread has been treated, cleared, reduced, or changed to act as a barrier between an advancing wildland fire and property or resources. In practice, defensible space is defined as an area a minimum of 30 feet around a structure that is cleared of flammable brush or vegetation.

Departure: The degree to which the current condition of a key ecosystem characteristic is unlike the reference condition.

Designated area: An area or feature identified and managed to maintain its unique special character or purpose. Some categories of designated areas may be designated only by statute and some categories may be established administratively in the land management planning process or by other administrative processes of the Federal executive branch. Examples of statutorily designated areas are national heritage areas, national recreational areas, national scenic trails, wild and scenic rivers, wilderness areas, and wilderness study areas. Examples of administratively designated areas are experimental forests, research natural areas, scenic byways, botanical areas, and significant caves (36 CFR 219.19).

Designated road, trail, or area: A National Forest System road, a National Forest System trail, or an area on National Forest System lands designated for motor vehicle use pursuant to 36 CFR 212.51 on a motor vehicle use map (36 CFR 212.1).

Desirable nonnative: Nonnative species that were intentionally released into the wild to establish self-sustaining populations of wildlife that meet public demands for recreation or other purposes (for example, sport fishes). These desirable nonnative species are not likely to cause ecosystem disruption.

Desired conditions: For the purposes of the land management planning regulation at 36 CFR 219, a description of specific social, economic, or ecological characteristics of the plan area or a portion of the plan area toward which management of the land and resources should be directed. Desired conditions must be described in terms that are specific enough to allow progress toward their achievement to be determined, but do not include completion dates (36 CFR 219.7(e)(1)(i)). Desired conditions are achievable, and may reflect social, economic, or ecological attributes, including ecosystem processes and functions.

Diameter: The diameter of a tree species, usually measured by two primary methods:

- Diameter at breast height is the diameter of a tree at the bole (or trunk) typically measured at 4.5 feet above ground level.
- Diameter at root collar is the diameter of a woodland tree species typically measured at the root collar (the part of the tree where the main roots join the trunk, usually at or near ground level) or at the natural ground line, whichever is higher.

Dispersed motorized camping: Camping with motorized vehicles outside of developed campsites.

Dispersed recreation: Outdoor recreation in which visitors are spread over relatively large areas outside developed recreation sites. Where facilities or developments are provided, they are more for access and protection of the environment than for the comfort or convenience of the visitors.

Disturbance: Any relatively discrete event in time that disrupts ecosystem, watershed, community, or species population structure, function, or both and changes resources, substrate availability, or the physical environment (36 CFR 219.19).

Disturbance regime: A description of the characteristic types of disturbance on a given landscape; the frequency, severity, and size distribution of these characteristic disturbance types; and their interactions (36 CFR 219.19).

Diversity: An expression of community structure; high if there are many equally abundant species; low if there are only a few equally abundant species. The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.

Easement: A type of special use authorization (usually granted for linear rights-of-way) that is utilized in those situations where a conveyance of a limited and transferable interest in National Forest System land is necessary or desirable to serve or facilitate authorized long-term uses, and that may be compensable according to its terms (36 CFR 251.51).

Ecological conditions: The biological and physical environment that can affect the diversity of plant and animal communities, the persistence of native species, and the productive capacity of ecological systems. Ecological conditions include habitat and other influences on species and the environment. Examples of ecological conditions include the abundance and distribution of aquatic and terrestrial habitats, connectivity, roads and other structural developments, human uses, and invasive species (36 CFR 219.19).

Ecological integrity: The quality or condition of an ecosystem when its dominant ecological characteristics (for example, composition, structure, function, connectivity, and species composition and diversity) occur within the natural range of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human influence (36 CFR 219.19).

Ecological process: The physical, chemical, and biological actions or events that link organisms and their environment including decomposition, production (of plant matter), nutrient cycling, and fluxes of nutrients and energy.

Ecological response unit: A classification of a unit of land that groups sites by similar plant species composition, succession patterns, and disturbance regimes, such that similar units will respond in a similar way to disturbance, biological processes, or manipulation. Each ecological response unit characterizes sites with similar composition, structure, function, and connectivity, and defines their spatial distribution on the landscape.

Ecological sustainability: See sustainability.

Ecological system: See ecosystem.

Economic sustainability: See sustainability.

Ecosystem: (36 CFR 219.19) A spatially explicit, relatively homogeneous unit of the Earth that includes all interacting organisms and elements of the abiotic environment within its boundaries. An ecosystem is commonly described in terms of its:

- Composition. The biological elements within the different levels of biological organization, from genes and species to communities and ecosystems.
- Structure. The organization and physical arrangement of biological elements, such as, snags and down woody debris, vertical and horizontal distribution of vegetation, stream habitat complexity, landscape pattern, and connectivity.
- Function. Ecological processes that sustain composition and structure, such as energy flow, nutrient cycling and retention, soil development and retention, predation and herbivory, and natural disturbances, such as wind, fire, and floods.
- Connectivity. See connectivity above.

Ecosystem diversity: The variety and relative extent of ecosystems (36 CFR 219.19).

Ecosystem integrity: See ecological integrity.

Ecosystem services: Benefits people obtain from ecosystems, including:

- Provisioning services, such as clean air and fresh water, energy, food, fuel, forage, wood products or fiber, and minerals;
- Regulating services, such as long-term storage of carbon; climate regulation; water filtration, purification, and storage; soil stabilization; flood and drought control; and disease regulation;
- Supporting services, such as pollination, seed dispersal, soil formation, and nutrient cycling; and
- Cultural services, such as educational, aesthetic, spiritual, and cultural heritage values, recreational experiences, and tourism opportunities.

Ecotone: The transition zone between two adjoining ecological communities.

Effect: Environmental change resulting from a proposed action. Direct effects are caused by the action and occur at the same time and place, while indirect effects are caused by the action, but are later in time or further removed in distance, although still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems. Effect and impact are synonymous as used in this document.

Encroachment: An increase in the density and cover of trees or shrubs in grasslands that reduces grass biomass, density, and cover.

Endangered species: Any species that the Secretary of the Interior or the Secretary of Commerce has determined is in danger of extinction throughout all or a significant portion of its range. Endangered species are listed at 50 CFR sections 17.11, 17.12, and 224.101.

Endemic: (1) Describes a population that has unique genetic characteristics and likely exists in a very limited geographic area. (2) Describes a population of native insects, diseases, plants, or animals which perform a functional role in the ecosystem when they are present at low levels, or constantly attack just a few hosts throughout an area but can become potentially injurious when they increase or spread to reach outbreak (epidemic) levels.

Environmental impacts: Possible adverse effects caused by a development, industrial, or infrastructural project or by the release of a substance in the environment.

Ephemeral stream: A stream that flows only in direct response to precipitation in the immediate locality (watershed or catchment basin), and whose channel is at all other times above the zone of saturation.

Even-aged stand: A stand of trees composed of a single age class (36 CFR 219.19).

Federally listed species: Threatened or Endangered species listed under the Endangered Species Act, as amended. Candidate and proposed species are species which are being considered for Federal listing.

Federally recognized tribe: An Indian or Alaska Native Tribe, band, nation, pueblo, village, or community that the Secretary of the Interior acknowledges to exist as an Indian Tribe under the Federally Recognized Indian Tribe List Act of 1994, 25 U.S.C. 479a (36 CFR 219.19).

Fire intensity: The product of the available heat of combustion per unit of ground and the rate of spread of the fire, interpreted as the heat released per unit of time for each unit length of fire edge. The primary unit is British thermal unit per second per foot (Btu/sec/ft.) of fire front. See also fire severity.

Fire regime: The patterns, frequency, and severity of fire that occur over a long period of time across a landscape and its immediate effects on the ecosystem in which it occurs. There are five fire regimes that are classified based on frequency (average number of years between fires) and severity (amount of replacement of the dominant overstory vegetation) of the fire. These five regimes are:

- Fire regime I – 0 to 35 year frequency and low (surface fires most common, isolated torching can occur) to mixed severity (less than 75 percent of dominant overstory vegetation replaced).
- Fire regime II – 0 to 35 year frequency and high severity (greater than 75 percent of dominant overstory vegetation replaced).
- Fire regime III – 35 to 100+ year frequency and mixed severity.
- Fire regime IV – 35 to 100+ year frequency and high severity.
- Fire regime V – 200+ year frequency and high severity.

Fire risk: The chance of fire starting, as determined by the presence and activity of causative agents.

Fire severity: Degree to which a site has been altered or disrupted by fire; also used to describe the product of fire intensity and residence time; usually defined by the degree of soil heating or mortality of vegetation.

Fire suppression: The work of extinguishing a fire or confining fire spread.

Forage: (1) browse and herbage which is available and can provide food for animals or be harvested for feeding or (2) to search for or consume forage.

Forested land: Land that is at least 10 percent occupied by forest trees of any size or formerly having had such tree cover and not currently developed for non-forest use. Lands developed for nonforest use include areas for crops, improved pasture, residential, or administrative areas, improved roads of any width, and adjoining road clearing and power line clearing of any width.

Free-flowing: Existing or flowing in natural conditions without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway.

Frequent fire-dependent ecosystem: A vegetation community that requires a fire regime 1 (>35 year fire frequency) to maintain its natural function, structure, and species composition.

Functional ecosystem: A system with intact abiotic and biotic processes. Function focuses on the underlying processes that may be degraded, regardless of the structural condition of the ecosystem. Functionally restored ecosystems may have a different structure and composition than the historical reference condition. As contrasted with ecological restoration that tends to seek historical reference condition, function refers to the dynamic processes that drive structural and compositional patterns. Functional restoration is the manipulation of interactions among process, structure, and composition in a degraded ecosystem to improve its operations. Functional restoration aims to restore functions and improve structures with a long-term goal of restoring interactions between function and structure. It may be, however, that a functionally restored system will look quite different than the reference condition in terms of structure and composition and these disparities cannot be easily corrected because some threshold of degradation has been crossed or the environmental drivers, such as climate, that influenced structural and (especially) compositional development have changed.

Gap: The space occurring in a forested area as a result of individual or group tree mortality from small disturbance events or from local site factors such as soil properties that influence vegetation growth patterns.

Goshawk foraging areas: The areas that surround the post-fledging family areas (see definition below) that northern goshawks use to hunt for prey. They are approximately 5,400 acres in size.

Goshawk nest areas: The areas immediately around a nest that are used by northern goshawks in relation to courtship and breeding activities. They are approximately 30 acres in size and contain multiple groups of large, old trees with interlocking crowns.

Goshawk post-fledging family areas: The areas that surround northern goshawk nest areas. They represent an area of concentrated use by the northern goshawk family until the time the young are no longer dependent on adults for food. Post-fledging family areas are approximately 420 acres in size (not including the nest area acres).

Groundcover: The layer of dead and living vegetation that provides protection of the topsoil from erosion and drought.

Groundwater-dependent ecosystem: Community of plants, animals, and other organisms whose extent and life processes depend on groundwater. Examples include many wetlands, groundwater-fed lakes and streams, cave and karst systems, aquifer systems, springs, and seeps.

Group: A cluster of two or more trees with interlocking or nearly interlocking crowns at maturity surrounded by an opening. Size of tree groups is typically variable depending on forested PNVT and site conditions and can range from fractions of an acre (a two-tree group) (i.e., ponderosa pine, dry mixed conifer) to many acres (wet mixed conifer, spruce-fir). Trees within groups are typically non-uniformly spaced, some of which may be tightly clumped.

Group selection: An uneven-aged management method in which trees are removed and new age classes are established in groups, adjacent to other groups of different age classes. Group cut size is determined by the reproduction requirements of the species desired and by the number or total acreage of different age classes desired across the stand.

Habitat: The physical location or type of environment in which an organism or biological population lives or occurs.

Habitat fragmentation: The process by which habitat loss results in the division of large, continuous habitats in smaller more isolated remnants.

Habitat type: A land or aquatic unit, consisting of an aggregation of habitats having equivalent structure, function, and responses to disturbance.

Herbaceous: Grass, grass-like, and forb vegetation.

Herbivory: Loss of vegetation due to consumption by another organism.

Hydrologic function: The behavioral characteristics of a watershed described in terms of ability to sustain favorable conditions of waterflow. Favorable conditions of waterflow are defined in terms of water quality, quantity, and timing.

Hydrologic unit code: A unique hierarchical hydrologic unit based on the area of land that drains to a single stream mouth or outlet at each level, and nested levels are identified by successively longer codes. A hydrologic unit code 8 subbasin is 700 square miles or larger and is divided into multiple hydrologic unit code 10 watersheds that range from 62 to 390 square miles. Hydrologic unit code 12 subwatersheds are 15 to 62 square miles and nest inside hydrologic unit code 10 watersheds.

Impaired waters: Polluted or degraded waterbodies (for example, lakes, streams, segments of streams) which do not meet state water quality standards.

Infill: An increase in trees per acre in forests and woodlands, resulting in a decrease in the quality and size of interspaces.

Information: For information collection from the public pursuant to 5 CFR part 1320, any statement or estimate of fact or opinion, regardless of form or format, whether in numerical, graphic, or narrative form, and whether oral or maintained on paper, electronic or other media. “Information” does not generally include items in the following categories; however, Office of Management and Budget personnel may determine that any specific item constitutes “information”:

- Affidavits, oaths, affirmations, certifications, receipts, changes of address, consents, or acknowledgments; provided that they entail no burden other than that necessary to identify the respondent, the date, the respondent's address, and the nature of the instrument (by contrast, a certification would likely involve the collection of “information” if an agency conducted or sponsored it as a substitute for a collection of information to collect evidence of, or to monitor, compliance with regulatory standards, because such a certification would generally entail burden in addition to that necessary to identify the respondent, the date, the respondent's address, and the nature of the instrument);
- Samples of products or of any other physical objects;
- Facts or opinions obtained through direct observation by an employee or agent of the sponsoring agency or through nonstandardized oral communication in connection with such direct observations;

- Facts or opinions submitted in response to general solicitations of comments from the public, published in the Federal Register or other publications, regardless of the form or format thereof, provided that no person is required to supply specific information pertaining to the commenter, other than that necessary for self-identification, as a condition of the agency's full consideration of the comment;
- Facts or opinions obtained initially or in follow-on requests, from individuals (including individuals in control groups) under treatment or clinical examination in connection with research on or prophylaxis to prevent a clinical disorder, direct treatment of that disorder, or the interpretation of biological analyses of body fluids, tissues, or other specimens, or the identification or classification of such specimens;
- A request for facts or opinions addressed to a single person;
- Examinations designed to test the aptitude, abilities, or knowledge of the persons tested and the collection of information for identification or classification in connection with such examinations;
- Facts or opinions obtained or solicited at or in connection with public hearings or meetings;
- Facts or opinions obtained or solicited through nonstandardized follow-up questions designed to clarify responses to approved collections of information; and
- Like items so designated by Office of Management and Budget personnel (5 CFR 1320.3(h)).

Infrastructure: Infrastructure the forest manages includes all vertical and horizontal constructed structures. Infrastructure is broken into three categories:

1. Transportation infrastructure includes both the road and trail systems. The road system infrastructure is all forest roads, drainage ditches, culverts, signage, and bridges. The trail system includes all motorized and nonmotorized trails, signage, and bridges.
2. Facilities infrastructure includes administrative and recreation building and sites (for example, driveways, parking, landscaping); support utilities (for example, electrical, water, wastewater); dams, and other support buildings.
3. Other infrastructure directly supports natural resources, which includes fish barriers, wildlife drinkers, and range infrastructure (for example, fencing, trick tanks, water gaps, cattleguards).

Inherent capability of the forest: The ecological capacity or ecological potential of an area characterized by the interrelationship of its physical elements, its climatic regime, and natural disturbances (36 CFR 219.19).

Integrated resource management: Multiple use management that recognizes the interdependence of ecological resources and is based on the need for integrated consideration of ecological, social, and economic factors (36 CFR 219.19).

Intermittent stream: A stream or reach of stream channel that flows, in its natural condition, only during certain times of the year or in several years, and is characterized by interspersed, permanent surface water areas containing aquatic flora and fauna adapted to the relatively harsh environmental conditions found in these types of environments. Intermittent streams are identified as dashed blue lines on U.S. Geological Survey (USGS) 7 1/2-inch quadrangle maps.

Interspaces: Open space between tree groups intended to be managed for grass-forb-shrub vegetation over the long term.

Invasive species: An alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health. A species that causes, or is likely to cause, harm and that is exotic to the ecosystem it has infested. Invasive species infest both aquatic and terrestrial areas and can be identified within any of the following four taxonomic categories: plants, vertebrates, invertebrates, and pathogens (Executive Order 13112). Sometimes referred to as nonnative invasives or exotic species.

Jackstrawing: Groups of fallen trees usually resulting from blowdown, avalanche, flood, or insect or disease mortality.

Land grant-*merced*: A grant of land made by the Government of Spain or of Mexico to a community, town, colony, pueblo, or person for the purpose of founding or establishing a community, town, colony, or pueblo.

Land grant-*merced* governing body: A community land grant-merced recognized under a State of New Mexico law, statute, or code, with a duly elected or appointed governance body charged with management, care, and protection of land grant-merced common lands.

Landscape: A defined area irrespective of ownership or other artificial boundaries, such as a spatial mosaic of terrestrial and aquatic ecosystems, landforms, and plant communities, repeated in similar form throughout such a defined area (36 CFR 219.19).

Leave No Trace: Guidelines that help protect the land and lessen the sights and sounds of forest visitors. http://www.lnt.org/

Line officer: A Forest Service official who serves in a direct line of command from the Chief (36 CFR 219.62).

Litter: Litter consists of dead, unattached organic material on the soil surface that is effective in protecting the soil surface from raindrop splash, sheet, and rill erosion and is at least ½ inch thick. Litter is composed of leaves, needles, cones, and woody vegetative debris including twigs, branches, and trunks.

Livestock grazing: Foraging by permitted livestock (domestic foraging animals of any kind).

Maintain: In reference to an ecological condition: To keep in existence or continuance of the desired ecological condition in terms of its desired composition, structure, and processes. Depending upon the circumstance, ecological conditions may be maintained by active or passive management or both (36 CFR 219.19).

Management actions: Any alterations to ecosystems or activities that the Forest Service conducts or authorizes on National Forest System lands. These may include prescribed cutting, prescribed burning, permitted grazing, permitted fuelwood gathering, vehicular access, stream restoration treatments, seeding, trail construction, fencing, among others.

Management area: A land area identified within the planning area that has the same set of applicable plan components. A management area does not have to be spatially contiguous (36 CFR 219.19).

Management system: For the purposes of the land management planning regulation at 36 CFR 219, a timber management system including even aged management and uneven-aged management (36 CFR 219.19).

Mechanical treatment: For the purposes of this plan, mechanical treatments include most vegetation treatments except fire. They may include mechanized cutting, hand thinning, and other silvicultural treatments.

Memorandum of understanding: Describes a bilateral or multilateral agreement between two or more parties. It expresses a convergence of will between the parties, indicating an intended common line of action. It is often used in cases where parties either do not imply a legal commitment or in situations where the parties cannot create a legally enforceable agreement. It is a more formal alternative to a gentlemen's agreement.

Minimum requirements analysis: Required by law whenever land managers are considering a use prohibited by Section 4(c) of the Wilderness Act of 1964, and is a process that was developed by the Arthur Carhart National Wilderness Training Center to help land managers make informed, defensible decisions that comply with the Wilderness Act.

Mitigate: To avoid, minimize, rectify, reduce, or compensate the adverse environmental impacts associated with an action.

Mollisol: A soil of an order comprising temperate grassland soils with dark, humus-rich surface layer containing high concentration of calcium and magnesium.

Monitoring: A systematic process of collecting information to evaluate effects of actions or changes in conditions or relationships (36 CFR 219.19).

Mosaic: Mix of recurring patterns of forested and non-forested areas at the identified scale (for example, landscape, watershed, mid-scale). Patterns are variable and may change over time.

Motor vehicle: Any vehicle which is self-propelled, other than:

- A vehicle operated on rails; and
- Any wheelchair or mobility device, including one that is battery-powered, that is designed solely for use by a mobility-impaired person for locomotion, and that is suitable for use in an indoor pedestrian area (36 CFR 212.1, 36 CFR 261.2).

Motor vehicle use map: A map reflecting designated roads, trails, and areas on an administrative unit or a ranger district of the National Forest System (36 CFR 212.1).

Multiple use: The management of all the various renewable surface resources of the NFS so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some land will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output, consistent with the Multiple-Use Sustained-Yield Act of 1960 (16 U.S.C. 528–531) (36 CFR 219.19).

National Environmental Policy Act (NEPA): A United States environmental law (42 U.S.C. 4321 et seq.), enacted January 1, 1970 that established a U.S. national policy promoting the enhancement of the environment. Additionally, it established the President's Council on Environmental Quality (CEQ).

National Forest System: Includes National Forests, National Grasslands, and the National Tallgrass Prairie (36 CFR 219.62).

National Forest System road: A forest road other than a road which has been authorized by a legally documented right-of-way held by a State, county or other local public road authority (36 CFR 212.1, 36 CFR 251.51, 36 CFR 261.2).

National Forest System trail: A forest trail other than a trail which has been authorized by a legally documented right-of-way held by a State, county or other local public road authority (36 CFR 212.1).

Native species: An organism that was historically or is present in a particular ecosystem as a result of natural migratory or evolutionary processes and not as a result of an accidental or deliberate introduction into that ecosystem. An organism's presence and evolution (adaptation) in an area are determined by climate, soil, and other biotic and abiotic factors (36 CFR 219.19).

Natural disturbance regime: The historic patterns (frequency and extent) of fire, insects, wind, landslides, floods, and other natural processes in an area.

Natural fire regime: The fire regime that existed prior to human facilitated interruption of frequency, extent, or severity.

Natural variability: Is a reference to past conditions and processes that provide important context and guidance relevant to the environments and habitats in which native species evolved. Disturbance driven spatial and temporal variability is vital to ecological systems. Biologically appropriate disturbances provide for heterogeneous conditions and subsequent diversity. Conversely, "uncharacteristic disturbance", such as high-intensity fire in plant communities that historically had a frequent low intensity fire regime can have the effect of reducing diversity, increasing homogeneity, and may result in permanently altered conditions.

Neonate ungulate: Offspring of a hoofed animal (for example, fawn or calf).

Nonindustrial wood (species): Includes aspen, junipers, piñon pines, oaks, and any industrial species cut from non-suitable timberlands. Wood cut as nonindustrial may be used as firewood or biomass.

Nutrient cycling: The circulation or exchange of elements such as nitrogen and carbon between non-living and living portions of the environment.

Objective: A concise, measurable, and time-specific statement of a desired rate of progress toward a desired condition or conditions. Objectives should be based on reasonably foreseeable budgets.

Off-highway vehicle: Any motorized vehicle designed for or capable of cross county travel on or immediately over land, water, sand, snow, ice, marsh, swampland, or other natural terrain; except that term excludes (A) any registered motorboat, (B) any fire, military, emergency or law enforcement vehicle when used for emergency purposes, and any combat or combat support vehicle when used for national defense purposes, and (C) any vehicle whose use is expressly authorized by the respective agency head under a permit, lease, license, or contract (Executive Order 116-44 as amended by Executive Order 11989). See also Forest Service Manual 2355. 01 - exhibit 01.

Old-growth characteristics: Old-growth forests are forests that have accumulated specific characteristics related to tree size, canopy structure, snags and woody debris, and plant associations. Ecological characteristics of old-growth forests emerge through the processes of succession. Certain features - presence of large, old trees, multilayered canopies, forest gaps, snags, woody debris, and a particular set of species that occur primarily in old-growth forests - do not appear simultaneously, nor at a fixed time in stand development. Old-growth forests support assemblages of plants and animals, environmental conditions, and ecological processes that are not found in younger forests (younger than 150 years) or in small patches of large, old trees. Specific attributes of old-growth forests develop through forest succession until the collective properties of an older forest are evident.

Online: Refers to the appropriate Forest Service website or future electronic equivalent (36 CFR 219.62).

Openings: Generally persistent treeless areas having a fairly distinct shape or size, occurring naturally due to differences in soil types as compared to sites that support forests or woodlands. Openings include meadows, grasslands, rock outcroppings, and wetlands. In contrast, created openings result from disturbances like severe fire or windthrow, or management activities to intentionally create space for new tree regeneration. Natural and created openings are not the same as interspaces found in the frequent-fire forests or woodlands. See interspaces.

Outstanding natural resource water: Streams, lakes and wetlands that receive special protection against degradation under New Mexico's water quality standards and the federal Clean Water Act. They are designated by the Water Quality Control Commission. Waters eligible for outstanding natural resource water designation include waters that are part of a national or state park, wildlife refuge or wilderness areas, special trout waters, waters with exceptional recreational or ecological significance, and high quality waters that have not been significantly modified by human activities (New Mexico Environment Department 2015).

Participation: Activities that include a wide range of public involvement tools and processes, such as collaboration, public meetings, open houses, workshops, and comment periods (36 CFR 219.19).

Patches: Areas larger than tree groups in which the vegetation composition and structure are relatively homogeneous. Patches compose the mid-scale, thus they range in size from 100 to 1,000 acres.

Perennial stream: A stream or reach of a channel that flows continuously or nearly so throughout the year and whose upper surface is generally lower than the top of the zone of saturation in areas adjacent to the stream. These streams are identified as solid blue on the USGS 7 1/2-inch quadrangle maps.

Permit area: Area in which an activity is authorized through a special use permit.

Persistence: Continued existence (36 CFR 219.19).

Plan or land management plan: A document or set of documents that provide management direction for an administrative unit of the National Forest System developed under the requirements of the land management planning regulation at 36 CFR part 219 or a prior planning rule (36 CFR 219.19).

Plan area: The National Forest System lands covered by a plan (36 CFR 219.19), specifically lands managed by Forest Service personnel as the Cibola National Forest.

Plan components: The parts of a land management plan that guide future project and activity decision-making. Specific plan components may apply to the entire plan area, to specific management areas or geographic areas, or to other areas as identified in the plan. Every plan must include the following plan components: desired conditions; objectives; standards; guidelines; suitability of lands. A plan may also include goals as an optional component.

Plan development: The second phase in the land management plan revision process. Plan development follows the NEPA process and plan revision requires preparation of an environmental impact statement. It is grounded in the information developed during the assessment phase and other information relevant to the plan area, it addresses needs for change, and it involves the public. Every plan must have management areas or geographic areas or both and may identify designated or recommended designated areas (36 CFR 219.7).

Plan monitoring program: An essential part of the land management plan that sets out the plan monitoring questions and associated indicators, based on plan components. The plan monitoring program informs management of resources on the plan area and enables the responsible official to determine if a change in plan components or other plan content that guide management of resources on the plan area may be needed.

Planned ignition: The intentional initiation of a wildland fire by hand-held, mechanical, or aerial device where the distance and timing between ignition lines or points and the sequence of igniting them is determined by environmental conditions (for example, weather, fuel, topography), firing technique, and other factors which influence fire behavior and fire effects. See prescribed fire.

Plant and animal community: A naturally occurring assemblage of plant and animal species living within a defined area or habitat (36 CFR 219.19).

Potential natural vegetation types: Comprise the “climax” vegetation that will occupy a site without disturbance or climatic change. Potential natural vegetation is an expression of environmental factors such as topography, soils, and climate across an area.

Prescribed fire: A wildland fire originating from a planned ignition to meet specific objectives identified in a written, approved, prescribed fire plan for which NEPA requirements have been met prior to ignition.

Primitive recreation: Reliance on personal skills and nonmotorized and nonmechanized means to travel and camp in an area, rather than reliance on facilities or outside help.

Productivity: The capacity of National Forest System lands and their ecological systems to provide the various renewable resources in certain amounts in perpetuity. For the purposes of the land management planning regulation at 36 CFR part 219, productivity is an ecological term, not an economic term (36 CFR 219.19).

Project: An organized effort to achieve an outcome on National Forest System lands identified by location, tasks, outputs, effects, times, and responsibilities for execution (36 CFR 219.19).

Projected timber sale quantity and projected wood sale quantity: The projected timber sale quantity and the projected wood sale quantity are estimated amounts of timber and other wood products that are expected to be produced under the plan's direction, based on objectives. Thus the estimation of these two quantities must be consistent with the plan components of the final plan or the unique mix of plan components in each alternative, and the fiscal and organizational capability of the unit. The planned management objectives for projected timber sale quantity and projected wood sale quantity are also limited based upon constraints described in Forest Service Handbook 1909.12, chapter 60, section 64.32.

Proper functioning condition: A methodology for assessing the physical functioning of riparian and wetland areas. The term proper functioning condition is used to describe both the assessment process, and a defined, on-the-ground condition of a riparian-wetland area. In either case, proper functioning condition defines a minimum or starting point.

Proposed species: Any species of fish, wildlife, or plant that is proposed by the U. S. Fish and Wildlife Service or the National Marine Fisheries Service in the Federal Register to be listed under section 4 of the Endangered Species Act. (36 CFR 219.19)

Range condition: A subjective expression of the status or health of the vegetation and soil relative to their combined potential to produce a sound and stable biotic community. (USDA Forest Service, Southwestern Region, record of decision for amendment of land management plans, Arizona and New Mexico). It is evaluated relative to desired conditions.

Rangelands: Forage-producing forested and nonforested lands.

Recommended wilderness: A recommended wilderness area within the National Forest System which has been recommended for official designation by the regional forester to the Chief of the Forest Service. The Chief may elect to forward the recommendation with wording for a congressional bill to the Secretary of Agriculture, who may then elect to transmit the proposed bill to Congress. It takes an act of Congress to designate a recommended wilderness area.

Recovery: For the purposes of the land management planning regulation at 36 CFR part 219 and with respect to threatened or endangered species: The improvement in the status of a listed species to the point at which listing as federally endangered or threatened is no longer appropriate (36 CFR 219.19).

Recreation opportunity: An opportunity to participate in a specific recreation activity in a particular recreation setting to enjoy desired recreation experiences and other benefits that accrue. Recreation opportunities include nonmotorized, motorized, developed, and dispersed recreation on land, water, and in the air (36 CFR 219.19).

Recreation setting: The social, managerial, and physical attributes of a place that, when combined, provides a distinct set of recreation opportunities. The Forest Service uses the recreation opportunity spectrum to define recreation settings and categorize them into six distinct classes: primitive, semi-primitive nonmotorized, semi-primitive motorized, roaded natural, rural, and urban (36 CFR 219.19).

Redundancy: The presence of multiple occurrences of ecological conditions such that not all occurrences may be eliminated by a catastrophic event.

Reference conditions: Environmental conditions that infer ecological sustainability. When available, reference conditions are represented by the characteristic natural range of variation (not the total range of variation), prior to European settlement and under the current climatic period. For many ecosystems, natural range of variation also reflects human-caused disturbance and effects prior to settlement. It may also be necessary to refine reference conditions according to contemporary factors (for example, invasive species) or projected conditions (for example, climate change). Reference conditions are most useful as an inference of sustainability when they have been quantified by amount, condition, spatial distribution, and temporal variation.

Regulated timber harvest: Tree harvest for the purposes of timber production, as opposed to tree harvest for other purposes, such as habitat and watershed improvement or fuelwood.

Representativeness: The presence of a full array of ecosystem types and successional states, based on the physical environment and characteristic disturbance processes.

Research natural areas: A physical or biological unit in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural physical and biological processes to prevail without human intervention. Research natural areas are principally for non-manipulative research, observation, and study. They are designated to maintain a wide spectrum of high quality representative areas that represent the major forms of variability found in forest, shrubland, grassland, alpine, and natural situations that have scientific interest and importance that, in combination, form a national network of ecological areas for research, education, and maintenance of biological diversity.

Resilience: The ability of an ecosystem and its component parts to absorb, or recover from the effects of disturbances through preservation, restoration, or improvement of its essential structures and functions and redundancy of ecological patterns across the landscape.

Responsible official: The official with the authority and responsibility to oversee the planning process and to approve a plan, plan amendment, and plan revision (36 CFR 219.62).

Restoration, ecological: The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Ecological restoration focuses on reestablishing the composition, structure, pattern, and ecological processes necessary to facilitate terrestrial and aquatic ecosystems sustainability, resilience, and health under current and future conditions (36 CFR 219.19).

Restore: To renew by the process of restoration. See restoration (36 CFR 219.19).

Riparian areas: Three-dimensional ecotones [the transition zone between two adjoining communities] of interaction that include terrestrial and aquatic ecosystems that extend down into the groundwater, up above the canopy, outward across the floodplain, up the near-slopes that drain to the water, laterally into the terrestrial ecosystem, and along the water course at variable widths (36 CFR 219.19).

Riparian management zone: The interface between land and a river or stream. Plant habitats and communities along the river margins and banks are called riparian vegetation, characterized by hydrophilic plants.

Risk: A combination of the likelihood that a negative outcome will occur and the severity of the subsequent negative consequences (36 CFR 219.19).

Road: A motor vehicle route over 50 inches wide, unless identified and managed as a trail (36 CFR 212.1).

Road decommissioning: Activities that result in the stabilization and restoration of unneeded roads to a more natural state (36 CFR 212.1). It includes a range of activities from ripping and seeding to full reclamation by restoring the original topography. Road decommissioning results in the removal of a National Forest System road from the forest transportation atlas.

Road maintenance levels:

- Maintenance level 1. Roads closed to vehicular traffic intermittently for periods that exceed 1 year. Can be operated at any other maintenance level during periods of use.
- Maintenance level 2. Roads open and maintained for use by high-clearance vehicles; surface smoothness is not a consideration. Most have native material surface (not paved and no aggregate surface).
- Maintenance level 3. Roads open and maintained for use by standard passenger cars. Most have gravel surface.
- Maintenance level 4. Roads open and maintained for use by standard passenger cars and to provide a moderate degree of user comfort and convenience at moderate travel speeds. Most are paved or have an aggregate surface.
- Maintenance level 5. Roads open and maintained for use by standard passenger cars

Routine maintenance: Work that is planned to be accomplished on a continuing basis, generally annually or more frequently (Forest Service Handbook 7709.58, 13.41).

Scale: Desired conditions are described at multiple scales where appropriate. Descriptions at various scales are sometimes necessary to provide adequate detail and guidance for the design of future projects and activities that will help achieve the desired conditions over time. The three scales used in this plan are:

- Fine scale is an area 10 acres or less in size at which the distribution of individual trees (single, grouped, or aggregates of groups) is described. Fine-scale desired conditions provide the view that can be observed standing in one location on the ground. Fine-scale desired conditions typically contain greater variability, which is desirable for providing heterogeneity at smaller spatial scales.
- Mid-scale desired conditions are composed of assemblages of fine-scale units and have descriptions that would be averaged across areas of 100- to 1,000-acre units.
- Landscape scale is an assemblage of 10 or more mid-scale units, typically totaling more than 10,000 acres, composed of variable elevations, slopes, aspects, soils, plant associations, and disturbance processes. Landscape scale desired conditions provide the big picture overview with resolution that would, for example, be observable from an airplane or from a zoomed out Google Earth view. The landscape scale is also appropriate scale for describing less common components that would not necessarily occur on every mid-scale unit within the landscape.

Scenery Management System: A classification system that recognizes scenery as the visible expression of dynamic ecosystems functioning within “places”, which have unique aesthetic and social values. It recognizes that in addition to naturally occurring features, positive scenery attributes associated with social, cultural, historical, and spiritual values, including human presence and the built environment, can also be valued elements of the scenery. The Scenery Management System also allows for “seamless” analysis and conservation beyond National Forest System lands into adjacent communities and other jurisdictions, through the application of varying scenery “themes” within a single analysis. It is structured to emphasize "natural appearing” scenery.

Scenic character: A combination of the physical, biological, and cultural images that gives an area its scenic identity and contributes to its sense of place. Scenic character provides a frame of reference from which to determine scenic attractiveness and to measure scenic integrity (36 CFR 219.19).

Scenic integrity objective: A desired level of excellence based on physical and sociological characteristics of an area. Refers to the degree of acceptable alterations to the valued attributes of the characteristic landscape. Objectives include very high, high, moderate, and low.

Seral stage (seral state): One of a series of transitional plant communities that develop during gradual successive change following disturbance.

Silviculture: The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands using species silvics to meet the diverse needs and values of landowners and society on a sustainable basis. Under this definition, silvicultural treatments include all management activities that control the establishment, growth, composition, health, and quality of forested lands to achieve stated land management objectives. The use of prescribed fire on forested lands qualifies as a silvicultural treatment in the context of this definition.

Snags: Standing dead or partially dead trees (snag topped), often missing many or all limbs. They provide essential wildlife habitat for many species and are important for forest ecosystem function.

Soil condition rating: A qualitative rating developed within the Southwestern Region of the Forest Service that provides an overall picture of soil condition vital in sustaining ecosystems. It is based on three soil functions: the ability of soil to resist erosion, infiltrate water, and recycle nutrients. There are four soil condition ratings:

- Satisfactory: Soil function is being sustained and soil is functioning properly and normally.
- Impaired: The ability of the soil to function properly and normally has been reduced or there exists an increased vulnerability to degradation.
- Unsatisfactory: Degradation of vital soil functions result in the inability of the soil to maintain resource values, sustain outputs or recover from impacts.
- Inherently unstable: These soils are eroding faster than they are renewing themselves.

Soil disturbance: When the soil no longer functions because of the loss of surface organic material (affecting nutrient cycling), compaction (affecting regulation and partitioning of water and air flow), and severe burn (affecting nutrient cycling and biology), then soil disturbance has occurred.

Soil productivity: The inherent capacity of the soil to support appropriate site-specific biological resource management objectives, which includes the growth of specified plants, plant communities, or a sequence of plant communities to support multiple land uses.

Species of conservation concern: A species, other than federally recognized threatened, endangered, proposed, or candidate species, that is known to occur in the plan area and for which the Regional Forester has determined that the best available scientific information indicates substantial concern about the species' capability to persist over the long-term in the plan area (36 CFR 219.9(c)).

Species diversity: Abundance of different species (both plant and animal) on the Cibola National Forest and adjoining lands; species richness. The National Forest Management Act requires that land management plans provide for diversity of plant and animal communities.

Stand: A contiguous group of trees generally uniform in age class distribution, composition, condition, and structure, and growing on a site of generally uniform quality, to be a distinguishable unit, such as mixed, pure, even-aged, and uneven-aged stands. A stand is the fundamental unit of silviculture reporting and record keeping.

Standard: A mandatory constraint on project and activity decision-making, established to help achieve or maintain the desired condition or conditions, to avoid or mitigate undesirable effects, or to meet applicable legal requirements.

Stressors: For the purposes of the land management planning regulation at 36 CFR part 219, factors that may directly or indirectly degrade or impair ecosystem composition, structure, or ecological process in a manner that may impair its ecological integrity, such as an invasive species, loss of connectivity, or the disruption of a natural disturbance regime (36 CFR 219.19).

Subwatershed: A hydrologic unit code 12 watershed, the smallest subdivision considered in this assessment.

Suitable timberlands: Land to be managed for timber production on a regulated basis. Such lands are those which have been determined to meet the following criteria: (a) are available for timber production (not withdrawn for wilderness or other official designation by Congress, the Secretary of Agriculture, or Chief of the Forest Service); (b) are physically capable of producing crops of industrial wood without irreversible resource damage to soils productivity or watershed conditions; (c) adequate tree restocking within 5 years of final harvest is reasonably assured; (d) adequate information exists about responses to timber management activities; (e) timber management is cost efficient over the planning horizon in meeting forest objectives that include timber production; (f) timber production is consistent with meeting the management requirements and multiple use objectives specified in the land management plan or plan alternative; and (g) other management objectives do not limit timber production activities to the point where it is impossible to meet management requirements set forth in 36 CFR section 129.27 (per Forest Service Handbook 2409.13, WO amendment 2409.13-92-1, zero code and chapter 20).

Sustainability: The capability to meet the needs of the present generation without compromising the ability of future generations to meet their needs. For the purposes of the land management planning regulation at 36 CFR part 219, ‘‘ecological sustainability’’ refers to the capability of ecosystems to maintain ecological integrity; ‘‘economic sustainability’’ refers to the capability of society to produce and consume or otherwise benefit from goods and services including contributions to jobs and market and nonmarket benefits; and ‘‘social sustainability’’ refers to the capability of society to support the network of relationships, traditions, culture, and activities that connect people to the land and to one another, and support vibrant communities (36 CFR 219.19).

Sustainable recreation: The set of recreation settings and opportunities on the National Forest System that is ecologically, economically, and socially sustainable for present and future generations (36 CFR 219.19).

Sustainable yield limit: An estimate of the amount of commercial wood products that may be sustainably harvested over a long period.

Temporary road or trail: A road or trail necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road or trail and that is not included in a forest transportation atlas (36 CFR 212.1).

Terrestrial ecosystem: All interacting organisms and elements of the abiotic environment in those vegetation and soil types, which are neither aquatic nor riparian.

Terrestrial ecosystem survey: An inventory of soil types or terrestrial ecosystem units (terrestrial ecosystem units) on the Cibola National Forest. It contains predictions and limitations of soil and vegetation behavior for selected land uses. This survey also highlights hazards or capabilities inherent in the soil and the impact of selected uses on the environment.

Terrestrial ecosystem unit: The classification unit used in the terrestrial ecosystem survey. A spatially explicit area with a similar combination of soils, land types, and vegetation.

Threatened species: Any species that the Secretary of the Interior or the Secretary of Commerce has determined is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Threatened species are listed at 50 CFR sections 17.11, 17.12, and 223.102.

Thinning: An intermediate treatment made to reduce the stand density of trees primarily to improve growth, enhance forest health, recover potential mortality, emphasize desired tree species, and/or emphasize desired forest structure. Thinning methods include:

- Single-tree selection is used in uneven-aged silvicultural systems in which scattered individual trees of multiple sizes, age classes, or both are removed throughout the stand to achieve desired structural characteristics.
- Group selection is a method of regenerating uneven-aged stands in which trees are removed, and new age classes are established, in small groups. Small openings provide micro-environments suitable for tolerant regeneration and the larger openings provide conditions suitable for more intolerant regeneration. In the group-selection system, the management unit or stand in which regeneration, growth, and yield are regulated consists of a landscape containing an aggregation of groups.
- Sanitation cutting is the removal of dead, dying, or damaged trees to prevent or interrupt the spread of insects or disease.
- Salvage cutting is the removal of trees that have been killed or damaged by wildland fire, severe wind, insects or disease, or other natural disturbances.
- Even-aged regeneration is a cutting method by which a new stand with a single age class is created.
- Matrix thinning is the thinning of the “matrix” of trees outside of a regeneration area. The matrix is generally thinned from below to some specified density to increase stand vigor and resiliency.

- All-size free thinning is the removal of trees to control stand spacing and favor desired trees, using a combination of thinning criteria without regard to crown position.
- Thinning from below is the removal of trees from lower canopy positions while retaining the largest and most vigorous trees with the best-developed crowns.

Timber harvest: The removal of trees for wood fiber use and other multiple use purposes (36 CFR 219.19).

Timber production: The purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use (36 CFR 219.19).

Traditional community: A land-based rural community that has a long-standing history in and around the lands managed by the Forest Service.

Traditional cultural property: A property that is eligible for inclusion in the National Register of Historic Places based on its associations with the cultural practices, traditions, beliefs, lifeways, arts, crafts, or social institutions of a living community.

Tribal consultation: The timely, meaningful, and substantive dialogue between Forest Service officials who have delegated authority to consult, and the official leadership of federally recognized Indian Tribes, or their designated representatives, pertaining to USDA Forest Service policies that may have tribal implications.

Tree size: The diameter of the bole of a tree measured at breast height.

- Seedling/sapling: 0.0 to 4.9 inches in diameter
- Small tree: 5.0 to 9.9 inches in diameter
- Medium tree: 10 to 19.9 inches in diameter
- Large tree: at least 20.0 inches in diameter

Uncharacteristic wildfire: An increase in wildfire size, severity, and resistance to control compared to reference conditions which occurred historically. These fires result as a consequence of more continuous canopy cover, ladder fuels, and accumulated live and dead woody material. Uncharacteristic wildfires burn with more intensity; cause higher tree mortality; degrade watersheds; sterilize soils; and threaten adjacent communities, forest infrastructure, and wildlife habitat. See reference conditions.

Uneven-aged forests: Forests composed of three or more distinct age classes of trees, either intimately mixed or in small groups.

Uneven-aged management: The application of a combination of actions needed to simultaneously maintain continuous high forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes to provide a sustained yield of forest products. Cutting is usually regulated by specifying the number or proportion of trees of particular sizes to retain within each area, thereby maintaining a planned distribution of size classes. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection.

Ungulate: A hooved animal, which includes wildlife (for example, pronghorn, deer, and elk) and domestic livestock (for example, sheep, cattle, and horses).

Unplanned ignition: The initiation of a wildland fire by lightning or unauthorized and accidental human-caused fires. See wildfire.

Upland: May refer to areas, species, systems, or conditions that are characteristic of terrestrial ecosystems, as opposed to riparian or aquatic ecosystems.

Values to be protected (values at risk): Includes property; structures; physical improvements; natural and culture resources; community infrastructure; and economic, environmental, and social values.

Vegetation Dynamics Development Tool (VDDT): A software program that provides a state and transition modeling framework to examine the role of various transition agents and the effects of management actions that alter vegetative communities (ESSA Technologies Ltd. 2007).

Vegetation state: A combination of the dominant plan canopy cover class and (for forest and woodland) size class and density class within a potential natural vegetation type. See also seral state.

Vegetation structure: Both the vertical and horizontal dimensions of a vegetation type or plant community. The horizontal structure refers to spatial patterns of individual and groups of plants and openings, as well as plant size and species composition. The vertical component refers to the layers of vegetation between the forest floor and the top of the canopy. Each vegetation type has its own structure. For example, forests have greater vertical structure than a grassland or woodland based on the height of the dominant species.

Viable population: A population of a species that continues to persist over the long term with sufficient distribution to be resilient and adaptable to stressors and likely future environments.

Vigor: Relates to the relative robustness of a plant in comparison to other individuals of the same species. It is reflected primarily by the size of a plant (height, weight) and its parts in relation to its age and the environment in which it is growing.

Watershed: A region or land area drained by a single stream, river, or drainage network; a drainage basin (36 CFR 219.19). Specifically, a hydrologic unit code 10 watershed, larger than a subwatershed, and nested in a subbasin.

Watershed condition: The state of a watershed based on physical and biogeochemical characteristics and processes (36 CFR 219.19).

Wetlands: A specific subtype within the Wetland Riparian group of vegetation communities. In wetlands saturation with water is the dominant factor determining the nature of soil development and plant and animal communities. “For regulatory purposes under the Clean Water Act, the term wetlands means ‘those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.’ [taken from the EPA Regulations listed at 40 CFR 230.3(t)].” (USEPA 2015) The Wetland Riparian vegetation community as defined in this plan is slightly more inclusive and includes open water wetlands and cienegas that may not be considered wetlands for regulatory purposes.

Wild and scenic river: A river designated by Congress as part of the National Wild and Scenic Rivers System that was established in the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271 (note), 1271–1287) (36 CFR 219.19).

- Wild – Those rivers or segments of rivers free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive, and waters unpolluted. These represent vestiges of primitive America.
- Scenic – Those rivers or segments of rivers free of impoundments, with shorelines or watersheds still largely primitive, and shorelines largely undeveloped but accessible in places by roads.
- Recreational – Those rivers or segments of rivers readily accessible by road or railroad that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

Wilderness: Any area of land designated by Congress as part of the National Wilderness Preservation System that was established in the Wilderness Act of 1964 (16 U.S.C. 1131–1136) (36 CFR 219.19).

Wildfire: Unplanned ignition of a wildland fire (for example, fires caused by lightning or unauthorized and accidental human-caused fires) and escaped prescribed fires. See unplanned ignition.

Wildfire hazard: A fuel complex, defined by volume, type condition, arrangement, and location, that determines the degree or ease of ignition and of resistance to control.

Wildland: An area in which development is essentially nonexistent, except for roads, railroads, power lines, and similar transportation facilities. Structures, if any, are widely scattered.

Wildling: A native plant growing uncultivated in the wild: specifically, the collection or transplant of such whole live plants.

Wildland fire: A general term describing any nonstructure fire that occurs in the vegetation, natural fuels, or both. The two types of wildland fire are wildfires and prescribed fires. Other terms such as “fire-use fires,” “resource benefit fires,” or “suppression fires” are not used in this plan.

Wildland-urban interface: That area where human development adjoins public or private natural areas, or an intermix of rural and urban land uses. From a natural resource perspective, the wildland-urban interface is an area where increased human influence and land-use conversion are changing natural resource goods, services, and management techniques (Hermansen-Baez et al. 2009).

Windthrow: Trees susceptible to wind damage; for example, uprooting, toppling, and bole breakage.

Woodland: Lands with over 10 percent tree canopy cover where the majority of the trees are non-timber species (for example, piñon pine and juniper) not traditionally used for industrial wood products.

Woody biomass: The trees and woody plants, including limbs, tops, needles, leaves, and other woody parts, grown in a forest, woodland, or grassland environment, that are the byproducts of forest management used to produce bioenergy and the full range of bio-based products.

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